

SCIENCE in COMICS

Cities of Tomorrow



THE CASE OF THE SUSTAINABLE FUTURE

Disney

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THE CASE OF THE SUSTAINABLE FUTURE

Disney **Science in Comics** is a series of comics titles designed to build a sound knowledge base for kids 8-12 years old, on science themes related to features and secrets of the world around us.

In this fast-changing world, the future of cities will greatly impact the future of life on Earth. Science and Technologies can help developing sustainable cities able to meet the social, economic, and environmental goals of the United Nations 2030 Agenda for Sustainable Development. This book shows you how.

CITIES OF TOMORROW: THE CASE OF THE SUSTAINABLE FUTURE

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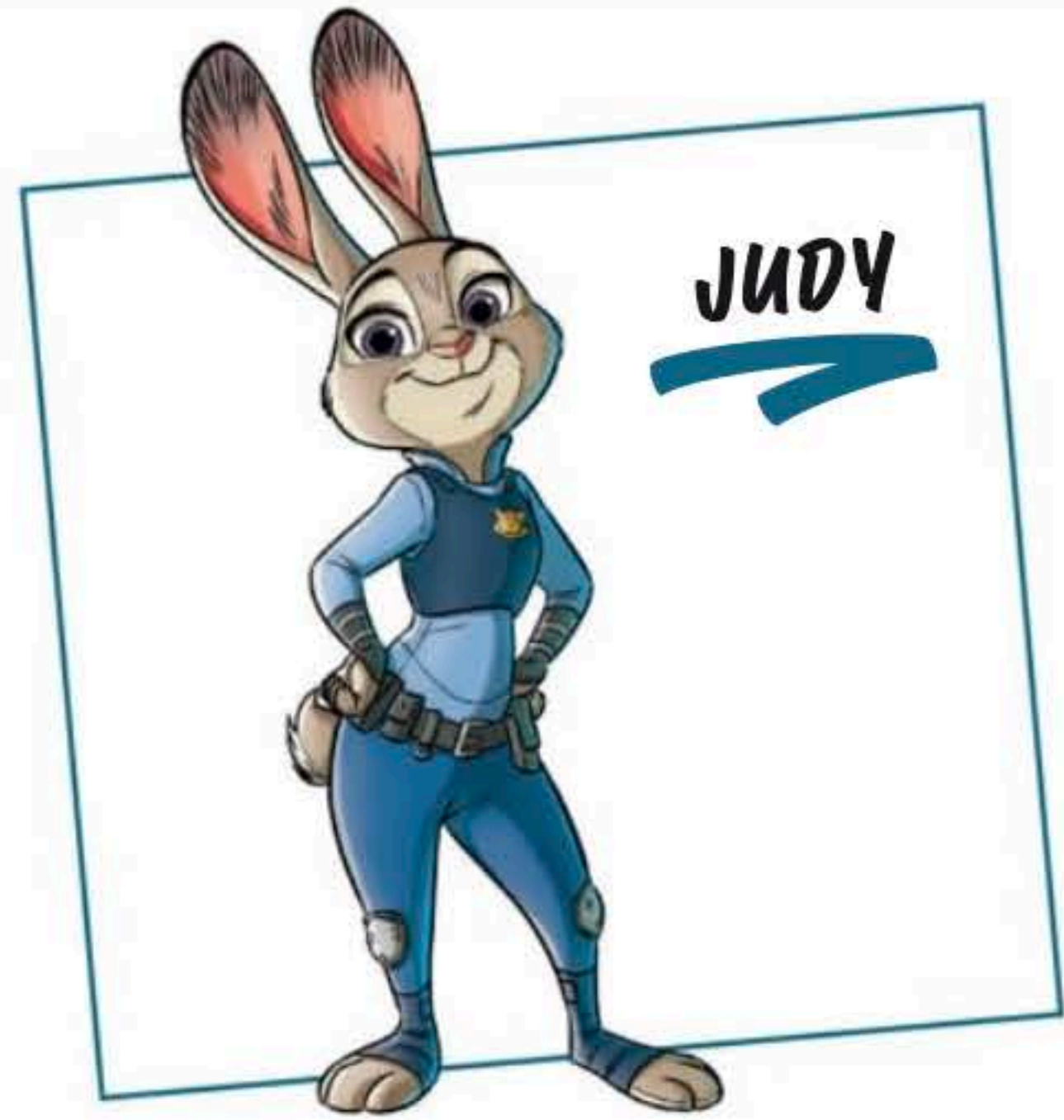
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Meet the heroes and new villains of Zootopia

Officer Judy Hopps is **strongly idealistic and independent**. Since her childhood in the countryside of Zootopia, she has pursued the dream of becoming a police officer, with the goal of making the world a better place. And that dream became true when she succeeded in becoming Zootopia Police Department's first rabbit officer.



Formerly a fox **con artist** with street smarts, Officer Nick Wilde met Judy during her first police investigation. After she helped him **change his view of himself**, he has become her partner in the Zootopia Police Department, and her **best friend**.



CHIEF BOGO

Police Chief Bogo is a **strict and no-nonsense** cape buffalo. Although at first he was rather skeptical of the only rabbit allowed in the Zootopia Police Department, he ended up **valuing Judy and accepting both her and Nick** as equals to all other agents in the force.



BONNIE & STU



Judy's parents, Bonnie and Stu, live in the rural neighborhood of Bunnyburrow, where they tend to **their carrots fields** as well as to a lot of young bunnies. When Judy left their home for the city, Daddy Stu was not very happy, **fearing that Zootopia was too dangerous** for his daughter. Since then, however, he has mellowed, **accepting her move and new lifestyle**.

Yax is a **free-spirited yak** who works at a naturist center in Zootopia. Despite his carefree and somewhat laid-back nature can make him look very oblivious of things, he has an **exceptional memory** and proves to be an **excellent source of information** for Judy and Nick.

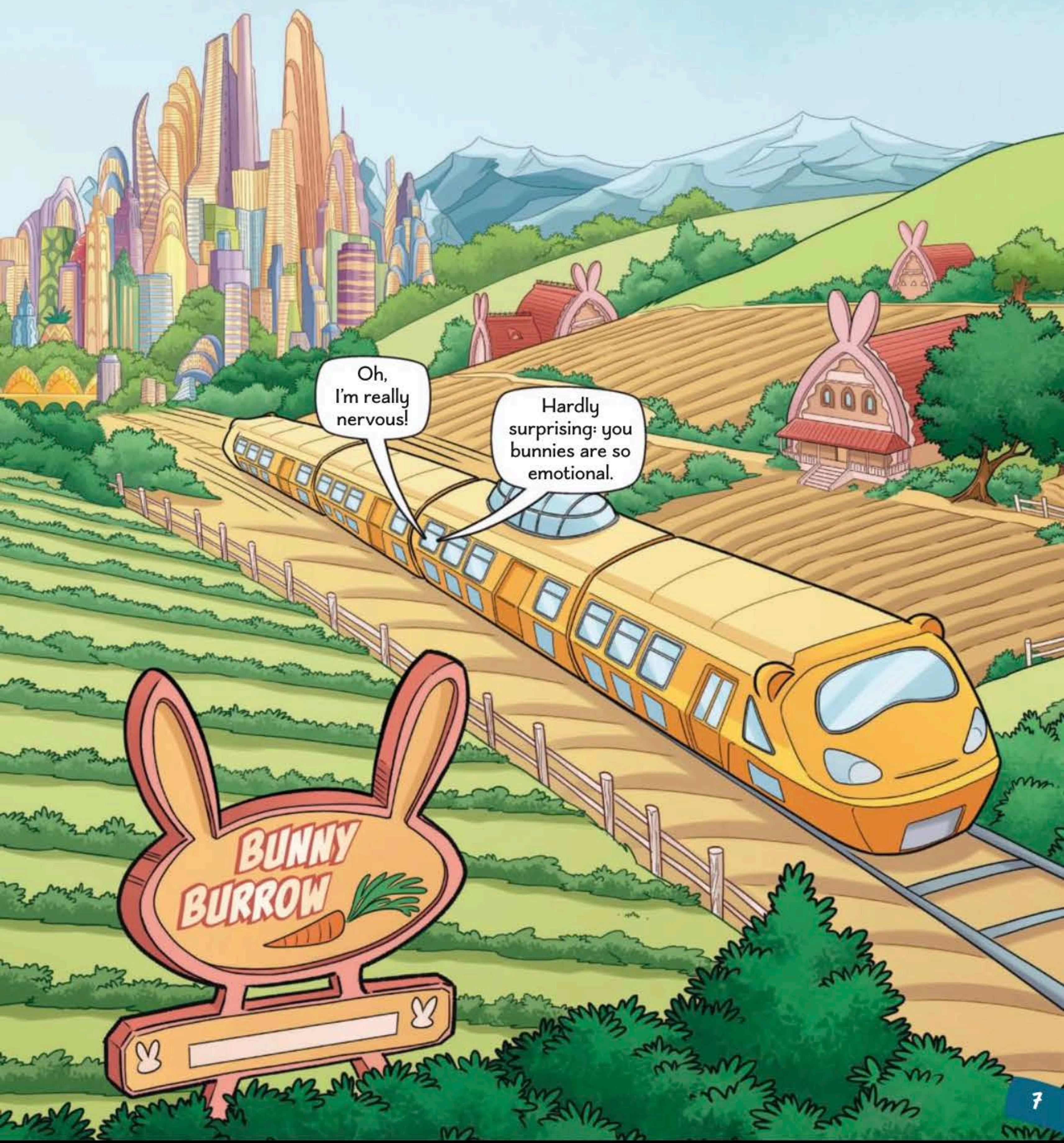


MR. SKUNKINGTON AND HIS HENCHMEN

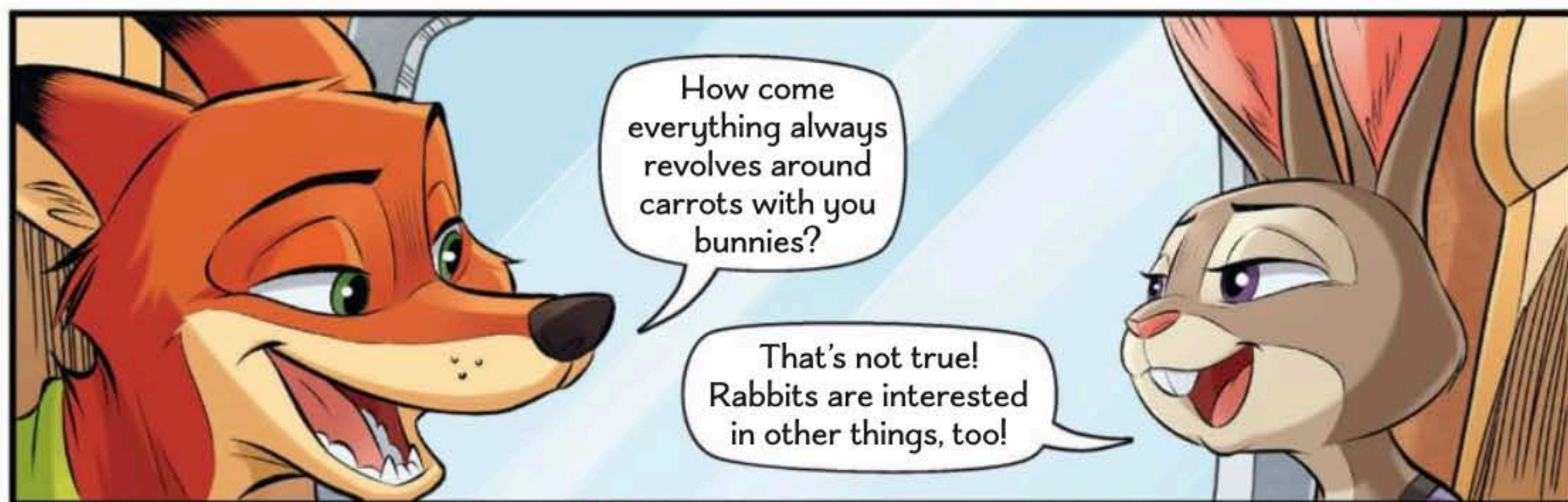


Dottie, Rings, and Stripe are a trio of nocturnal animals in the employ of the **Skunkington Disposal Company**. Dottie, the masked polecat, is the company's truck driver, but she's also the undisputed leader of the group, which includes raccoon Rings, the muscle, and slow-witted badger Stripe. All three are the henchmen of **Mr. Skunkington**, a seemingly respectable businessman who is making his fortune out of yard debris disposal.

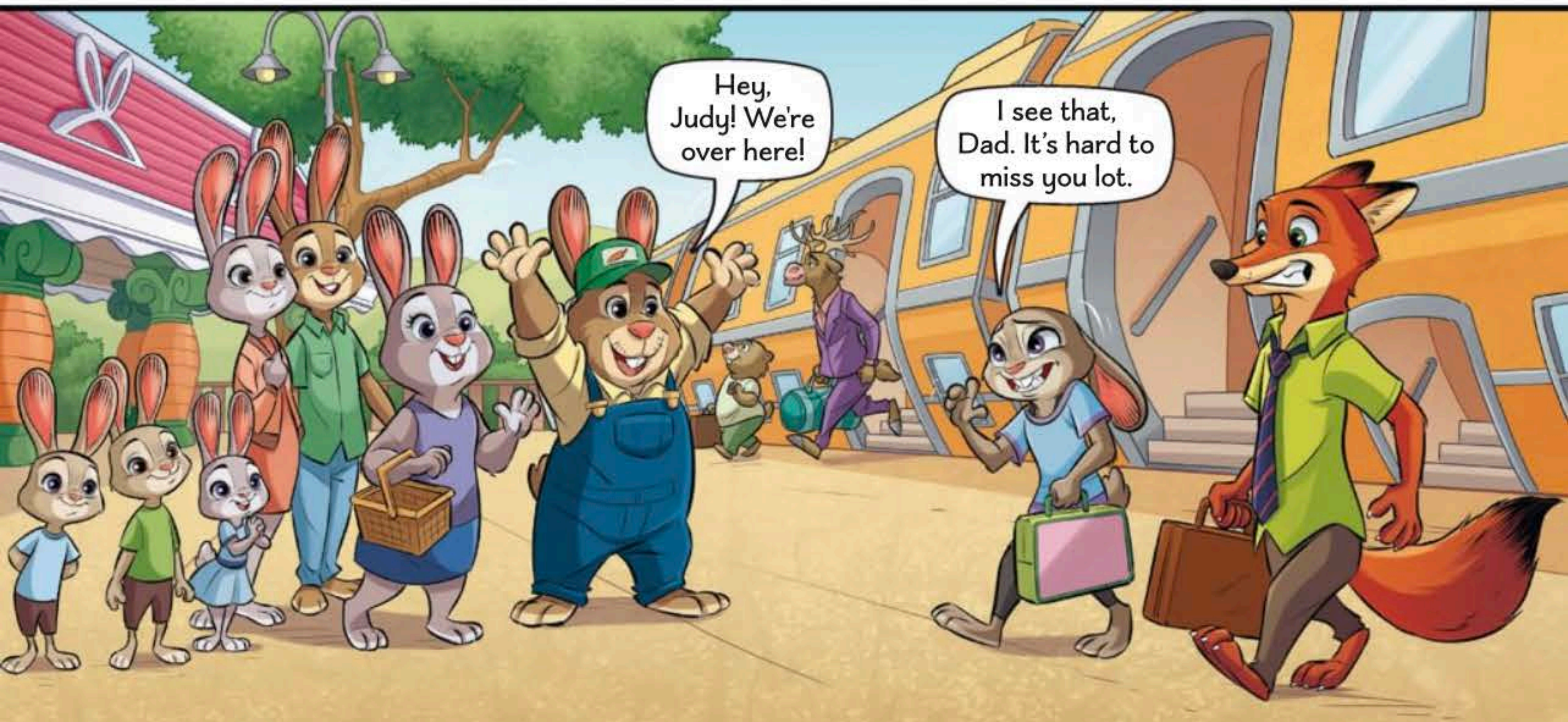
BACK HOME



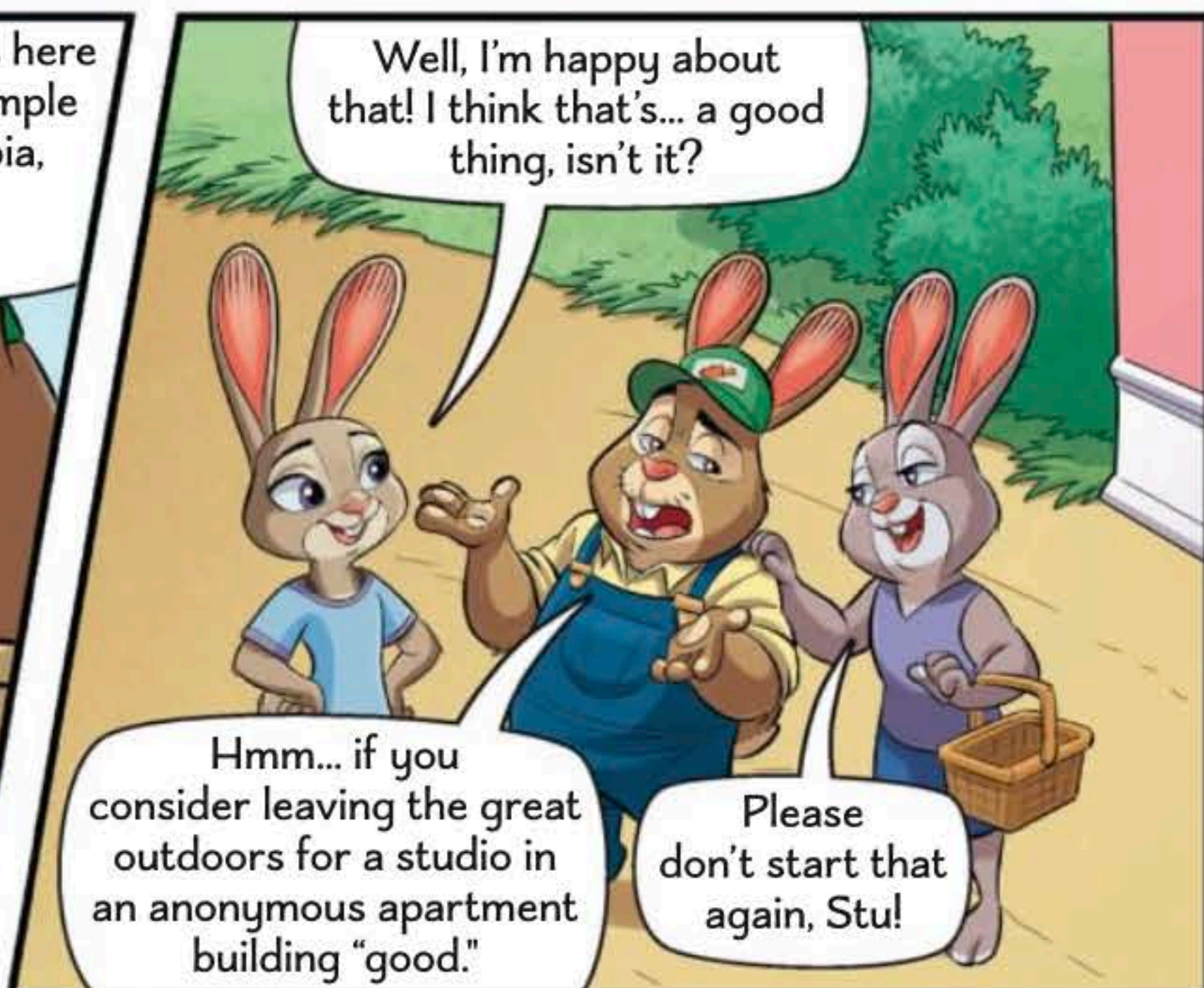
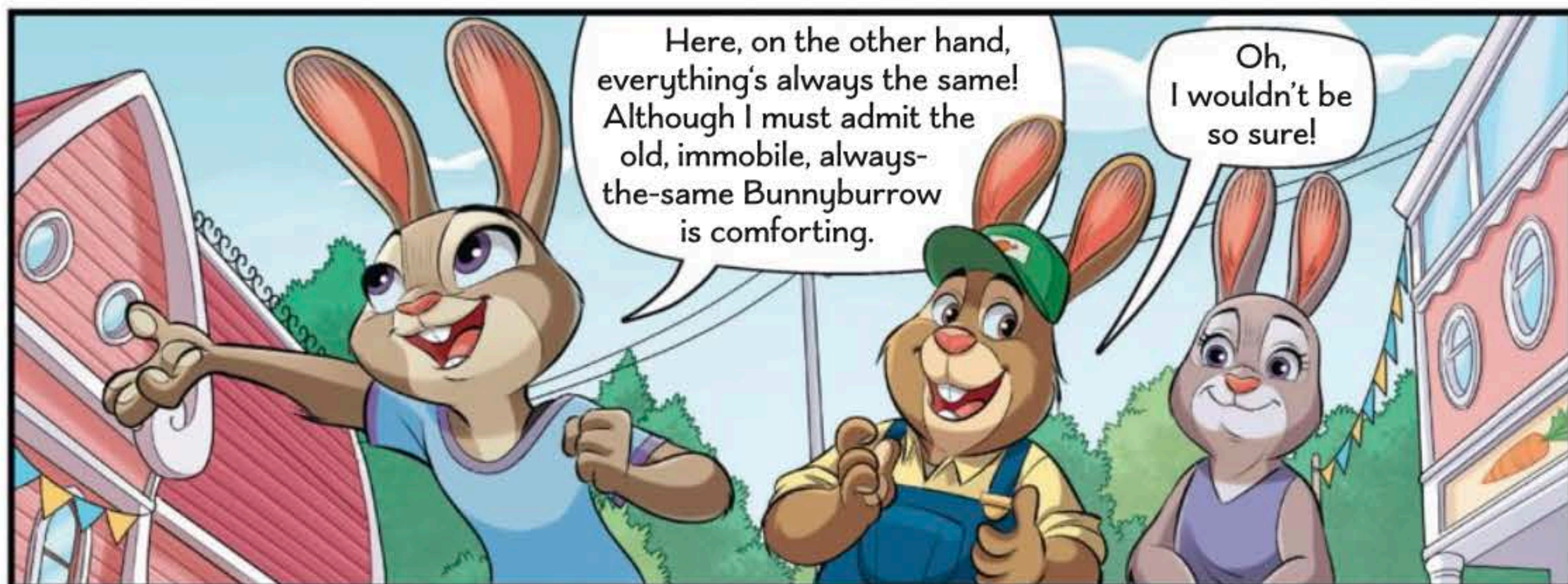




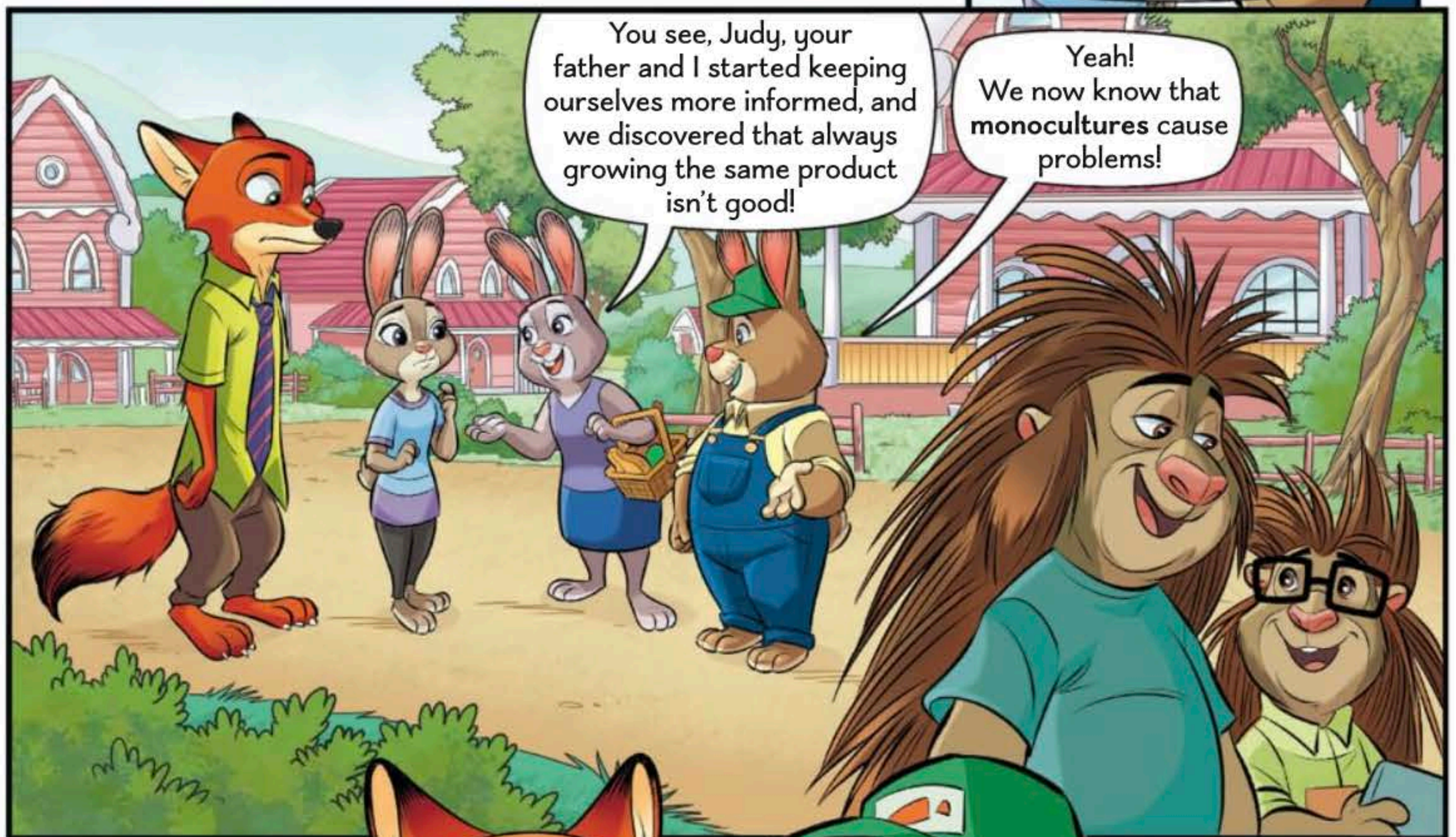


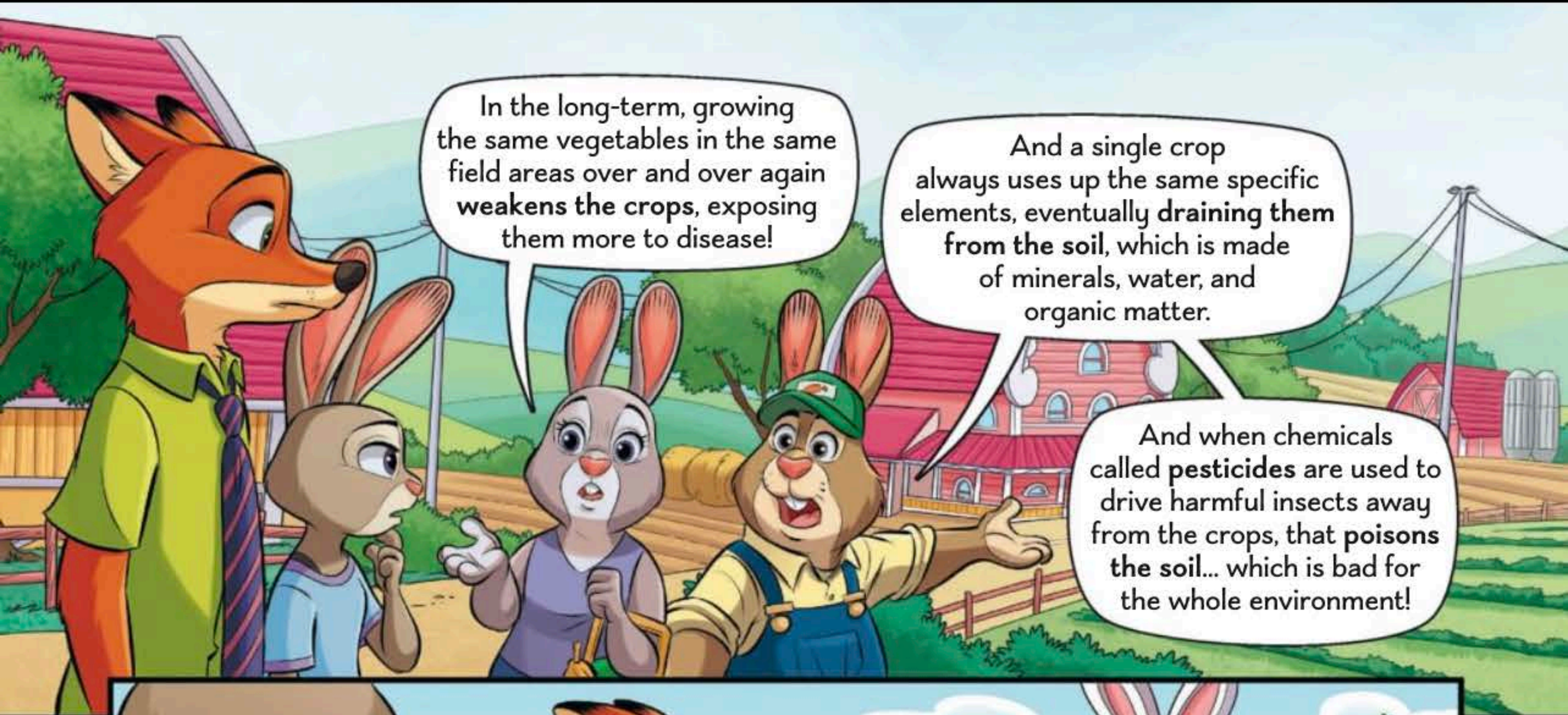












In the long-term, growing the same vegetables in the same field areas over and over again **weakens the crops**, exposing them more to disease!

And a single crop always uses up the same specific elements, eventually **draining them from the soil**, which is made of minerals, water, and organic matter.

And when chemicals called **pesticides** are used to drive harmful insects away from the crops, that **poisons the soil**... which is bad for the whole environment!



So, no more carrots?

Oh no, we still have those!

We just decided to focus on **variety**! Now we grow lots of different types, plus we give space to other crops, too. You'll see!



Later, on the porch...

Looks like your quiet little town isn't quite so unchanging after all.

You're right. I guess I'll just have to get used to all these new things.



After all, sounds like they're all changes for the better, right?

That's the spirit, Carrots!

CONTINUES ON PAGE 21

THE PLANET'S RESOURCES

- Planetary boundaries
- Ecological footprint
- Urbanization
- What will happen in the future?



Planetary boundaries

WHAT DOES EARTH GIVE US?

Earth is rich in **natural resources**, which can be found in the ground and forests, in the sea and freshwater, and even in the air! Natural resources are essential for some very important processes. For instance, **pollination**—the transfer of pollen that allows plants to reproduce—relies on wind, bees, and other animals. Climate is also affected by natural resources;

for example, plants ensure that Earth's temperature doesn't rise too much. Basically, natural resources are necessary for the planet to function properly. However, we must be careful because they are **limited**, meaning they can run out. That's why it's important to take good care of such resources and not to waste them.

When there's too much of a gas called carbon dioxide in the air, the temperature rises. Plants are very important since they absorb it, thus balancing the temperature values.

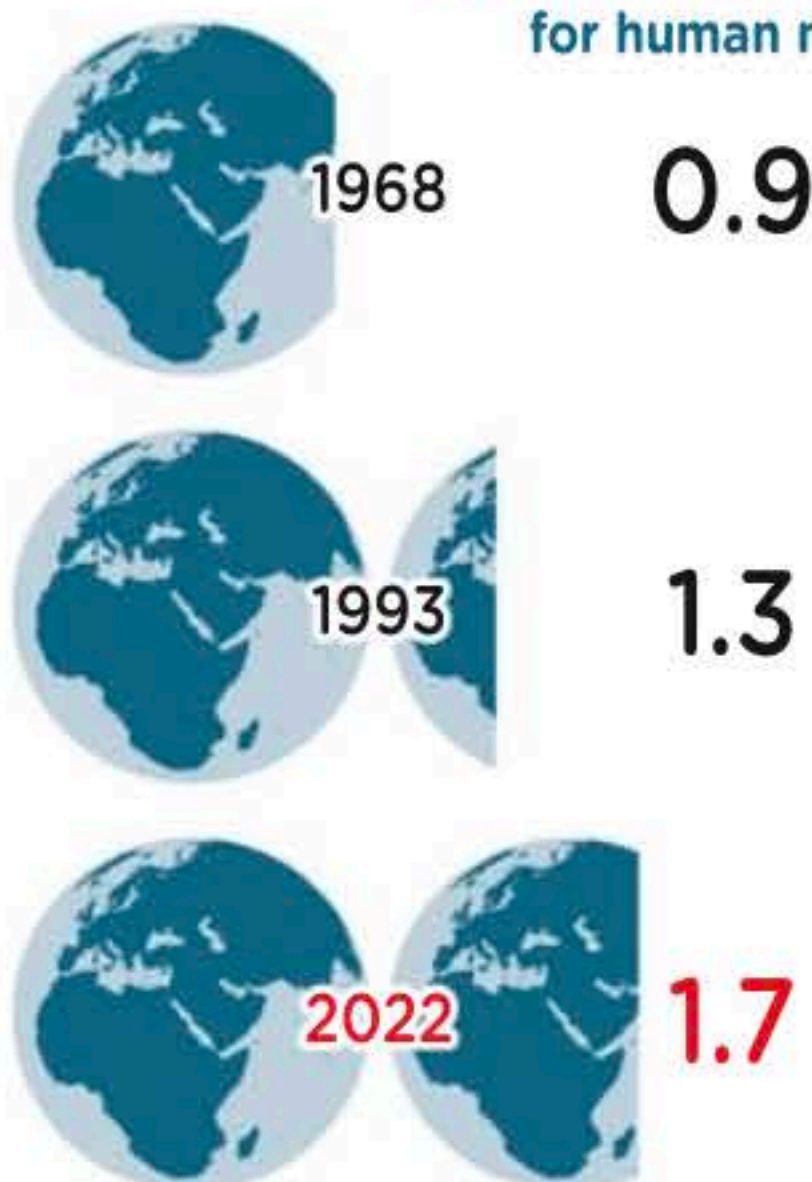


Ecological footprint

USING UP NATURAL RESOURCES

Earth has limited natural resources, which are used by both the planet itself and the life forms that live there. However, humans use more than their share of resources, leaving the planet with less than it needs

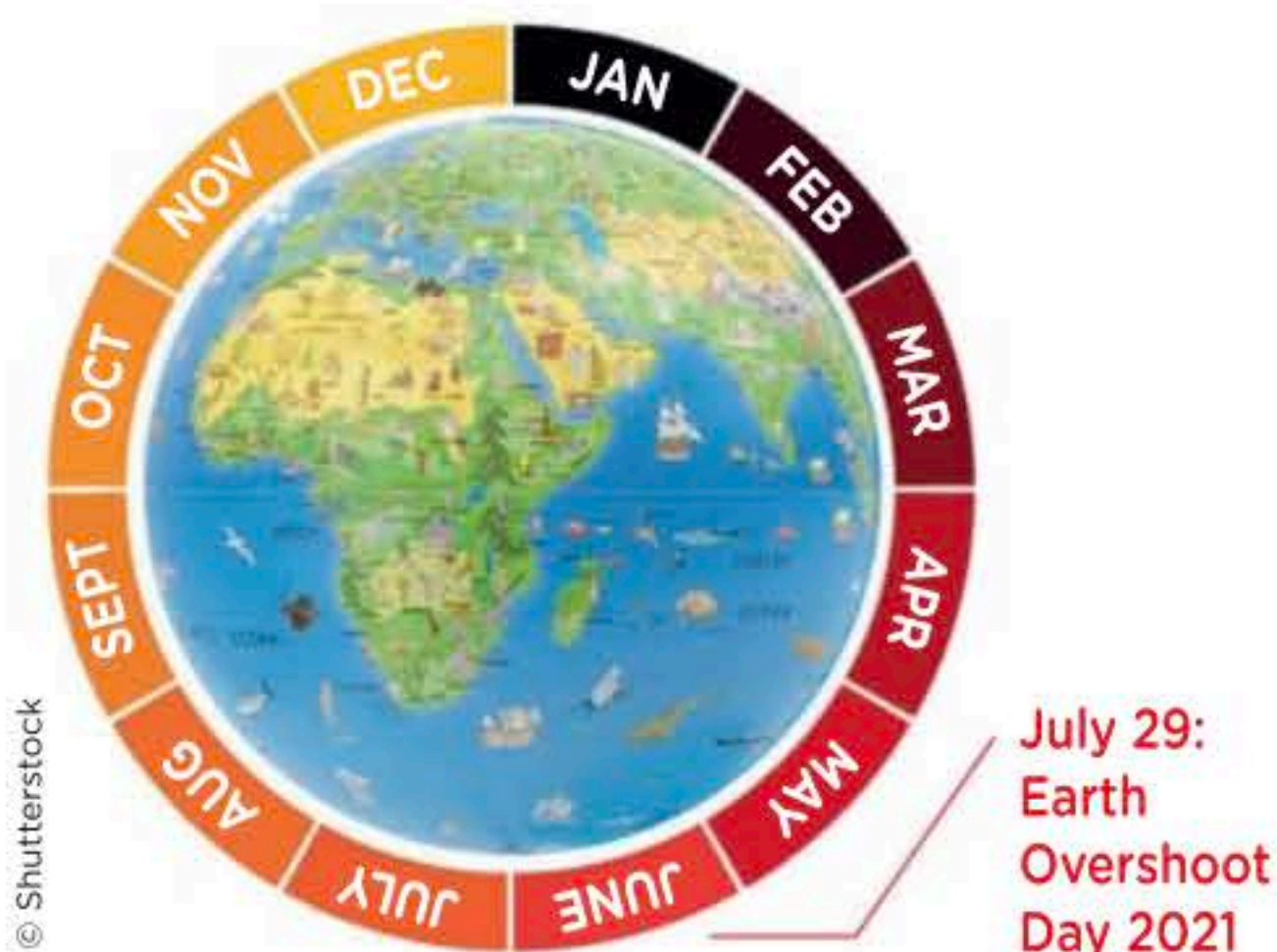
Number of Earths needed for human needs:



Over time, our ecological deficit has increased. Nowadays, we need one and a half Earths to meet human consumption, but we have only one!

IN DEBT TO EARTH

Earth Overshoot Day marks the date when the natural resources expected for the year run out. From



and causing some of its processes to function less effectively. But how do we know how much of the resources we can use? By calculating our **ecological footprint**, which measures how much humans take from nature by comparing the resources that they need to live with those that nature can produce.

When humans consume too much of the natural resources, or consume them too fast, an **ecological deficit** is created, meaning there's a shortage of resources: we're using more than Earth can provide.

that day on, humans' ecological deficit increases. It's very important and still possible to push forward Earth Overshoot Day by setting rules to reduce the human consumption of natural resources. For example, establishing a maximum number of trees that can be cut down to convert a forest into a farmland or into a new city district. However, in order for these limits to work, **everyone must respect them!**

In 2021, Earth Overshoot Day was identified as July 29: in just seven months, humans had consumed all the resources that Earth would produce over the whole year. And this day gets earlier each year!

Urbanization

EVERYONE IN THE CITY

Today, over half the world's population live in cities. This trend is called **urbanization**, and it's continuing to spread all over the world, particularly in Africa and Asia. Most people move to the city to seek work, get better health care and education, and have greater access to social services and enhanced opportunities for cultural and political participation. But everyone living closer together **increases the need for natural resources**, thus requiring their careful management so everyone can benefit from them. And it can also cause more air pollution and noise! Additionally, with more people living in the same city, **more waste is produced** in the same place, and managing it can become much more complicated.

Because cities are growing so fast, it is even more essential to respect Earth and its resources, which is happening more often now in modern cities. The city and the countryside may appear to have little in common, but today cities are increasingly incorporating elements typical of the countryside. For example, in addition to building a growing number of houses in green areas on the outskirts, more and more parks, playgrounds, and gardens are being added to more central neighborhoods. What's more, agriculture is increasingly entering urban areas, with city farms, urban gardens, and **vertical farms**, which are greenhouses arranged in different levels one over the other.



Growing fruit and vegetables in vertical farms housed in city buildings may waste fewer natural resources like water and soil.



What will happen in the future?

SUSTAINABLE DEVELOPMENT

Respecting limits on the use of available natural resources is a huge challenge for humanity. To achieve **sustainable development**, we must find a way of producing and consuming that avoids wasting resources so there is enough for everyone, including future generations. This can be

accomplished with the help of new scientific and technological discoveries that maximize what's available today. For instance, advances in the energy field have allowed us to produce more energy while polluting less, thus protecting people's and planet's health. Since humans can't live without clean air, water to drink, and plants to eat, sustainability is at the base of people's general well-being.

THE 2030 AGENDA

In 2015, the governments of the 193 member countries of the United Nations (UN) created the **2030 Agenda for Sustainable Development**. It consists of 17 very important goals, including no poverty, zero hunger, and climate action, to be achieved by 2030.

Number 11 highlights the importance of making our cities and communities more sustainable, for example, by ensuring access to adequate, safe, and affordable housing and basic services for all.

↓ The Global Goals, agreed to by world leaders, aim to build a better world by 2030, and we can all play our part, for example, by walking or taking the bus to school, rather than relying on the family car.



POPS HOPPS'S CROPS

The next day...



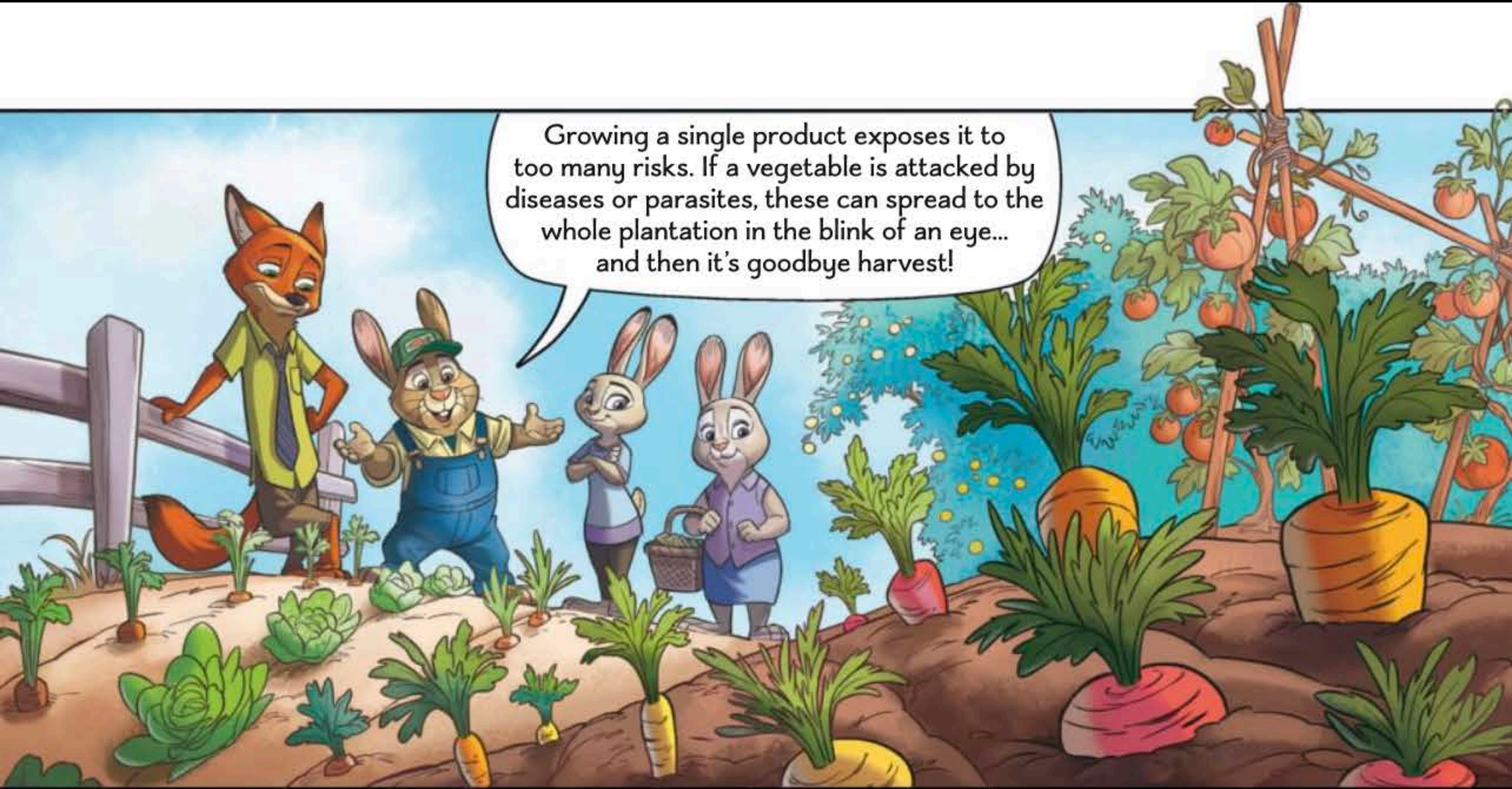
**HAPPY ALL
CARROTS! EVE,
EVERYBODY!**

Uh...
cheers!

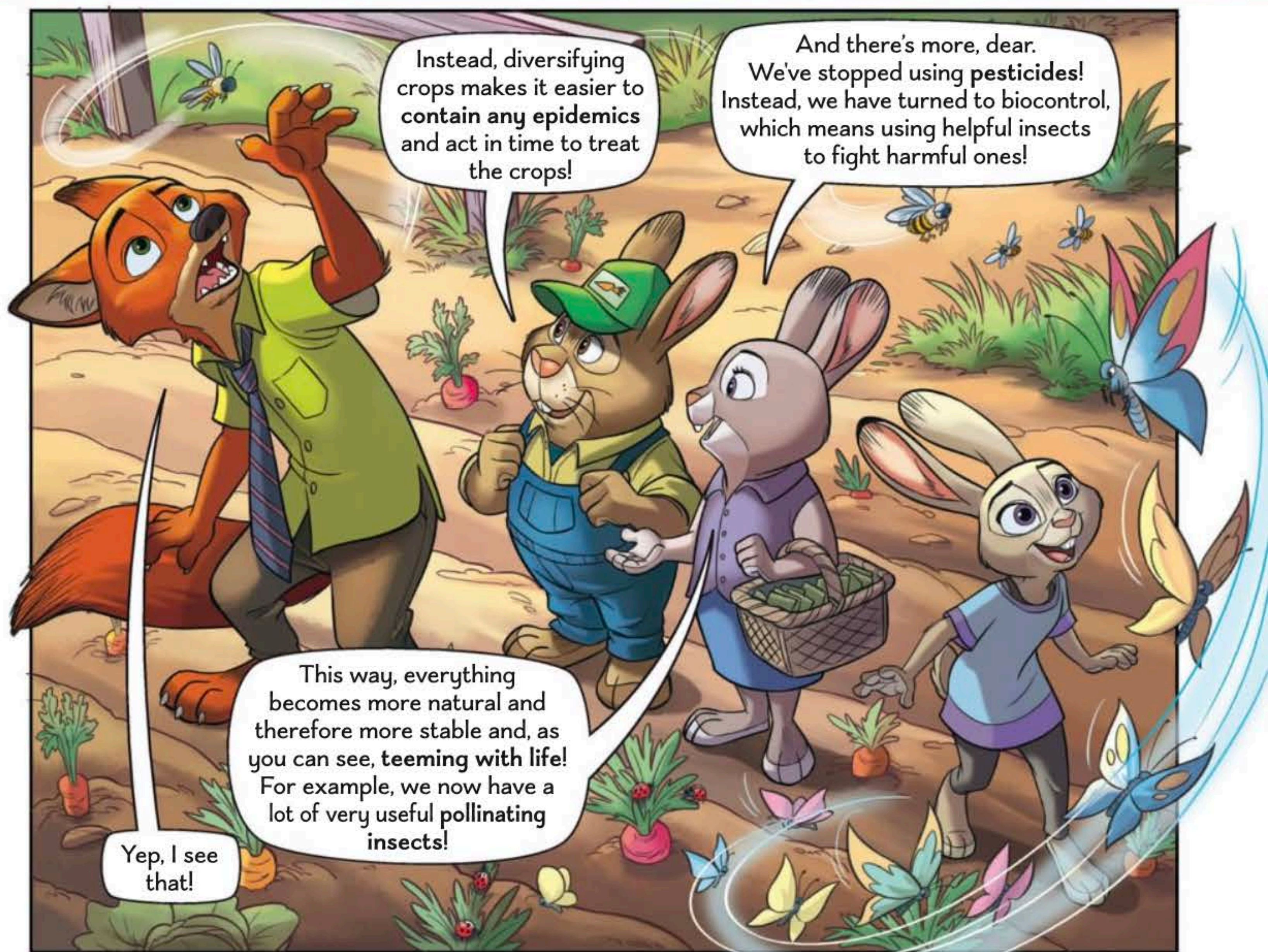


And so, after the lunch...





Growing a single product exposes it to too many risks. If a vegetable is attacked by diseases or parasites, these can spread to the whole plantation in the blink of an eye... and then it's goodbye harvest!



Instead, diversifying crops makes it easier to contain any epidemics and act in time to treat the crops!

And there's more, dear. We've stopped using pesticides! Instead, we have turned to biocontrol, which means using helpful insects to fight harmful ones!

This way, everything becomes more natural and therefore more stable and, as you can see, teeming with life! For example, we now have a lot of very useful pollinating insects!

Yep, I see that!



And what about the carrots?

No more identical carrots!

We now grow all kinds, instead of just a single type!



We have quite a variety: Little Paws, King Roots, Tendersweets, Fluffytails, Big Harveys, Moon Hares, as well as the white, red, rainbow, and yellow varieties... all together!

Wow, there are even purple ones!

Those, lad, are the authentic original carrots that my great-grandmother grew! A native and almost forgotten species... incredibly hardy, much more than the modern varieties!

Which means they are less vulnerable to disease! And this is what makes them particularly suitable for our organic farming!

Wow, Dad. I'm amazed! You've become a carrotologist!

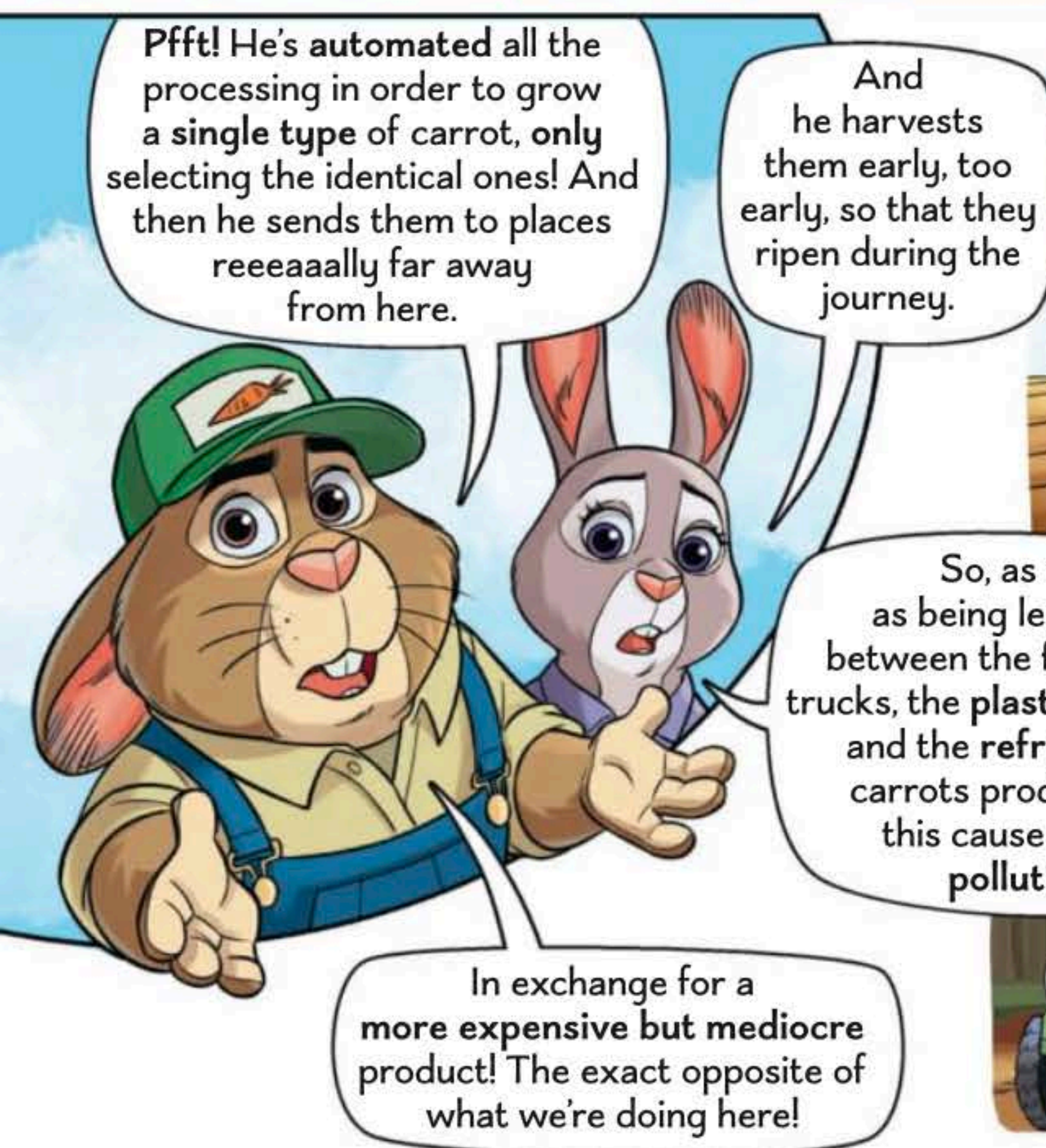
Well, you know, your mom and me had to adapt to the times.





Not like that troublemaker, Ned O'Hara, with his large estate just next door!

Shh, Stu, don't start that again! After all, he's modernized, too!

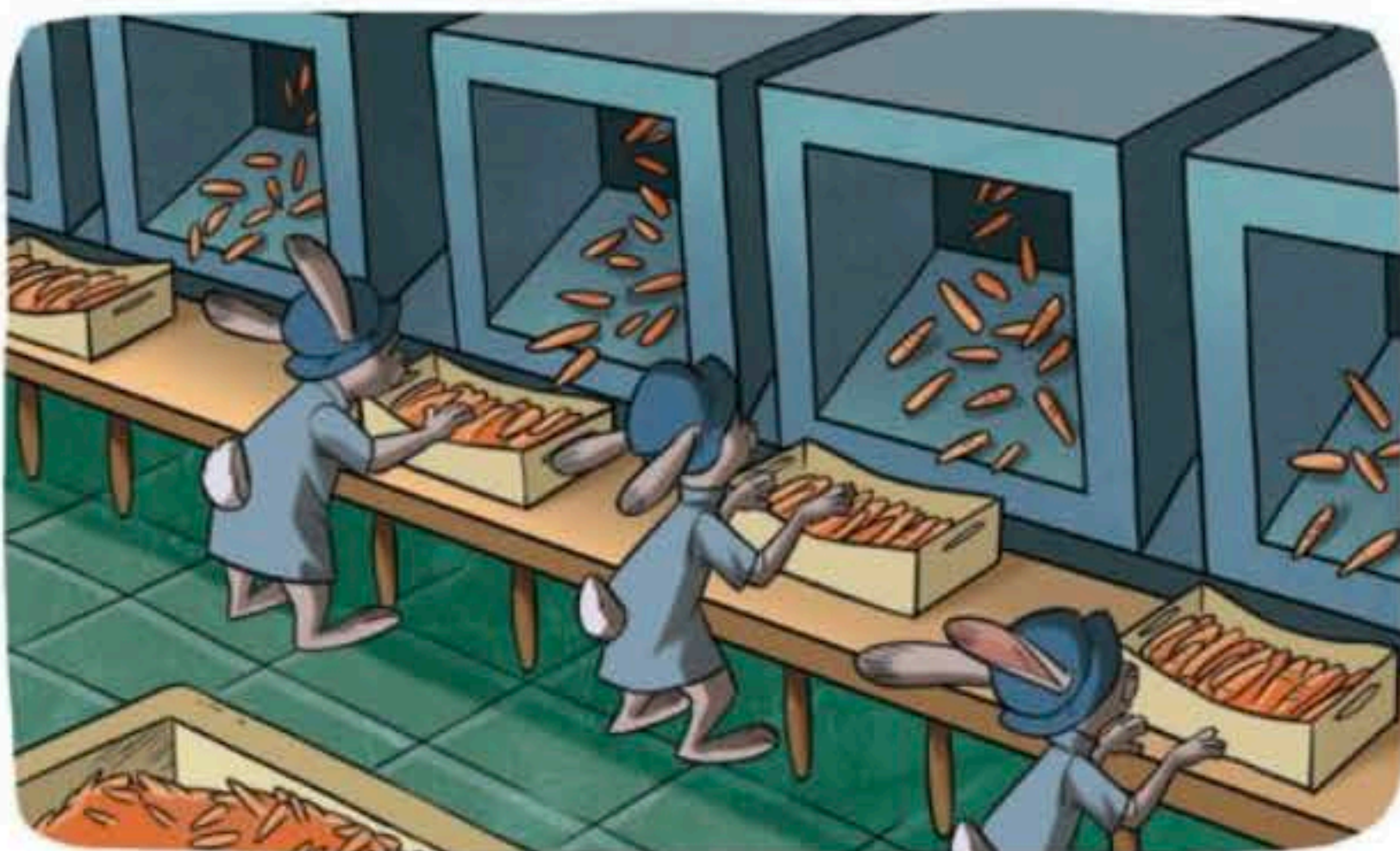
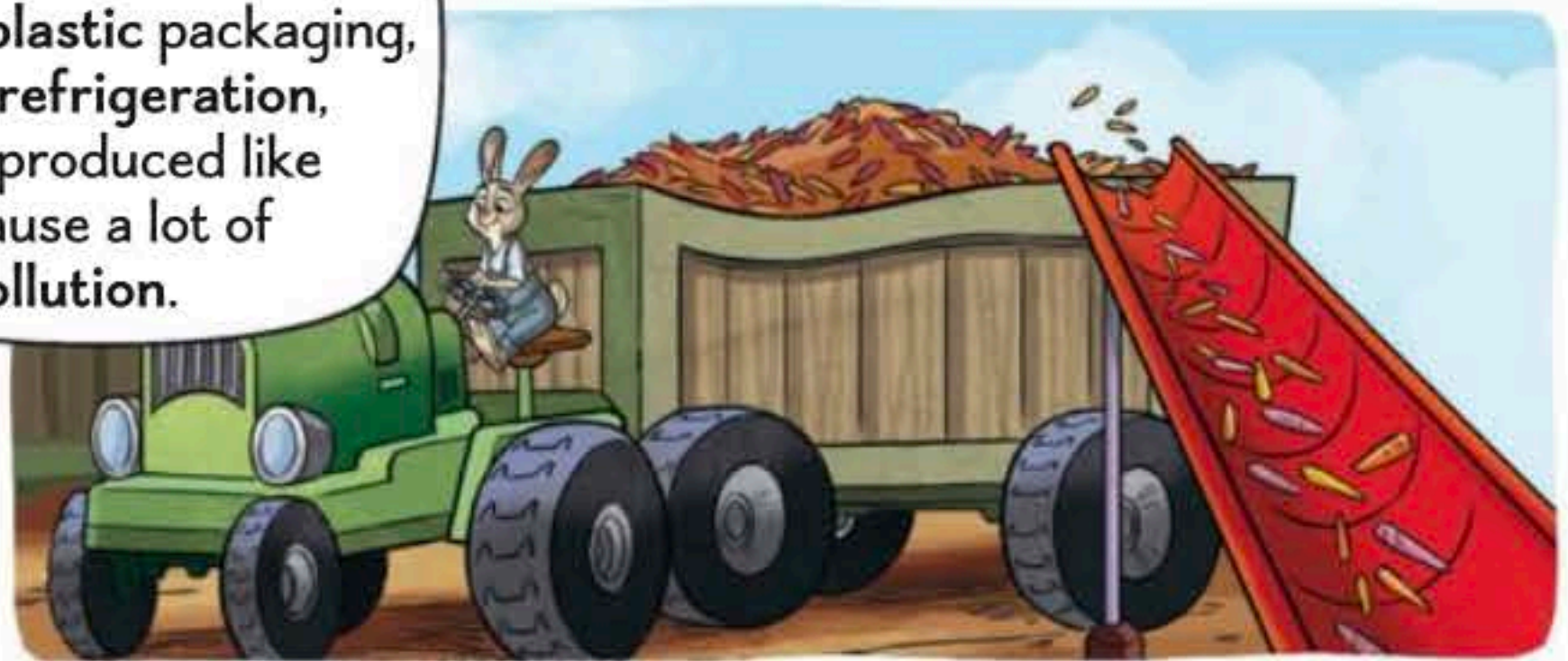


Pfft! He's automated all the processing in order to grow a **single type** of carrot, **only** selecting the identical ones! And then he sends them to places reeeaaally far away from here.

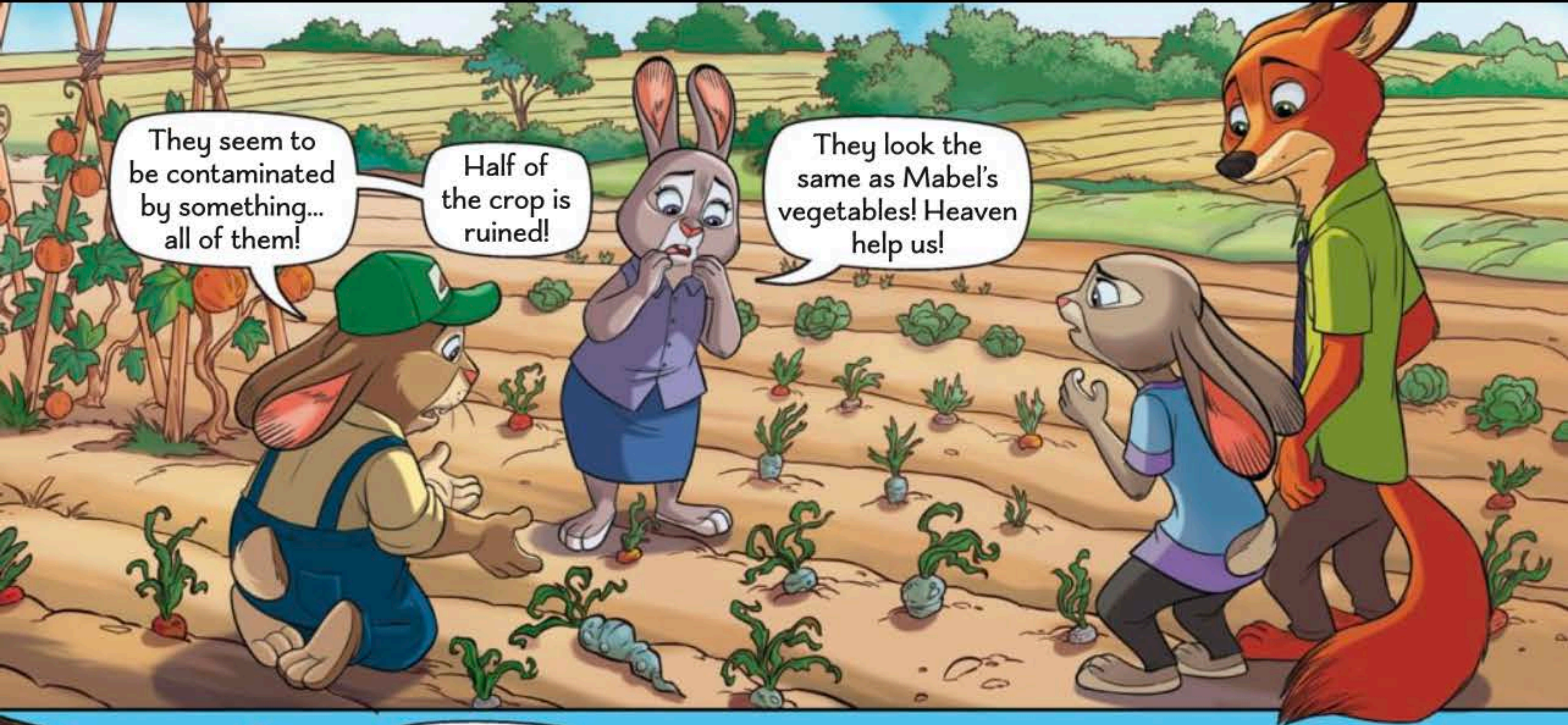
And he harvests them early, too early, so that they ripen during the journey.

So, as well as being less tasty, between the fuel for the trucks, the plastic packaging, and the **refrigeration**, carrots produced like this cause a lot of **pollution**.

In exchange for a **more expensive but mediocre** product! The exact opposite of what we're doing here!







They seem to be contaminated by something... all of them!

Half of the crop is ruined!

They look the same as Mabel's vegetables! Heaven help us!



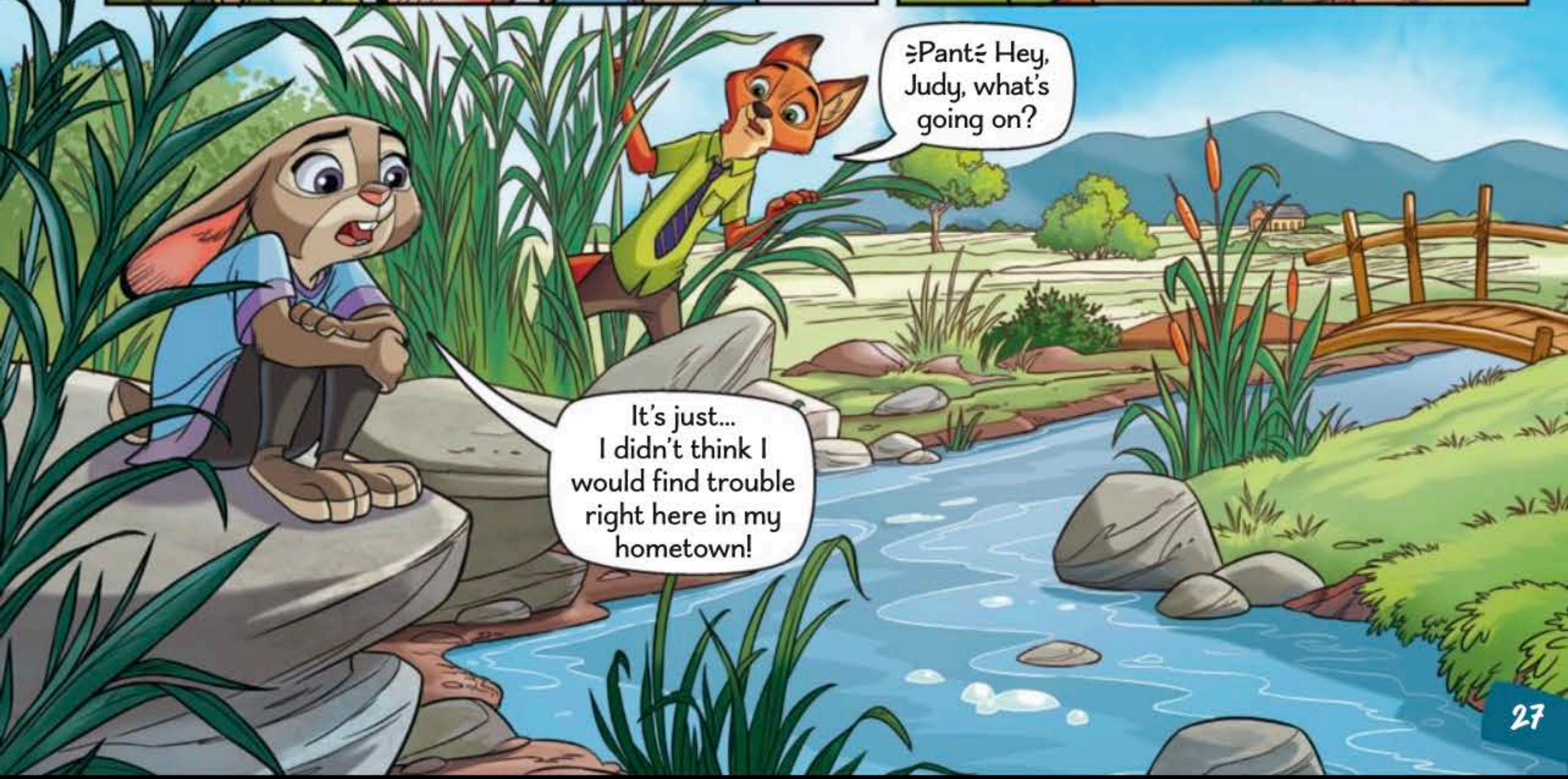
I gather that this is all pretty unusual?

Oh, Nick, this may very well be a tragedy! If the whole crop is unhealthy, my family's entire livelihood is blown!



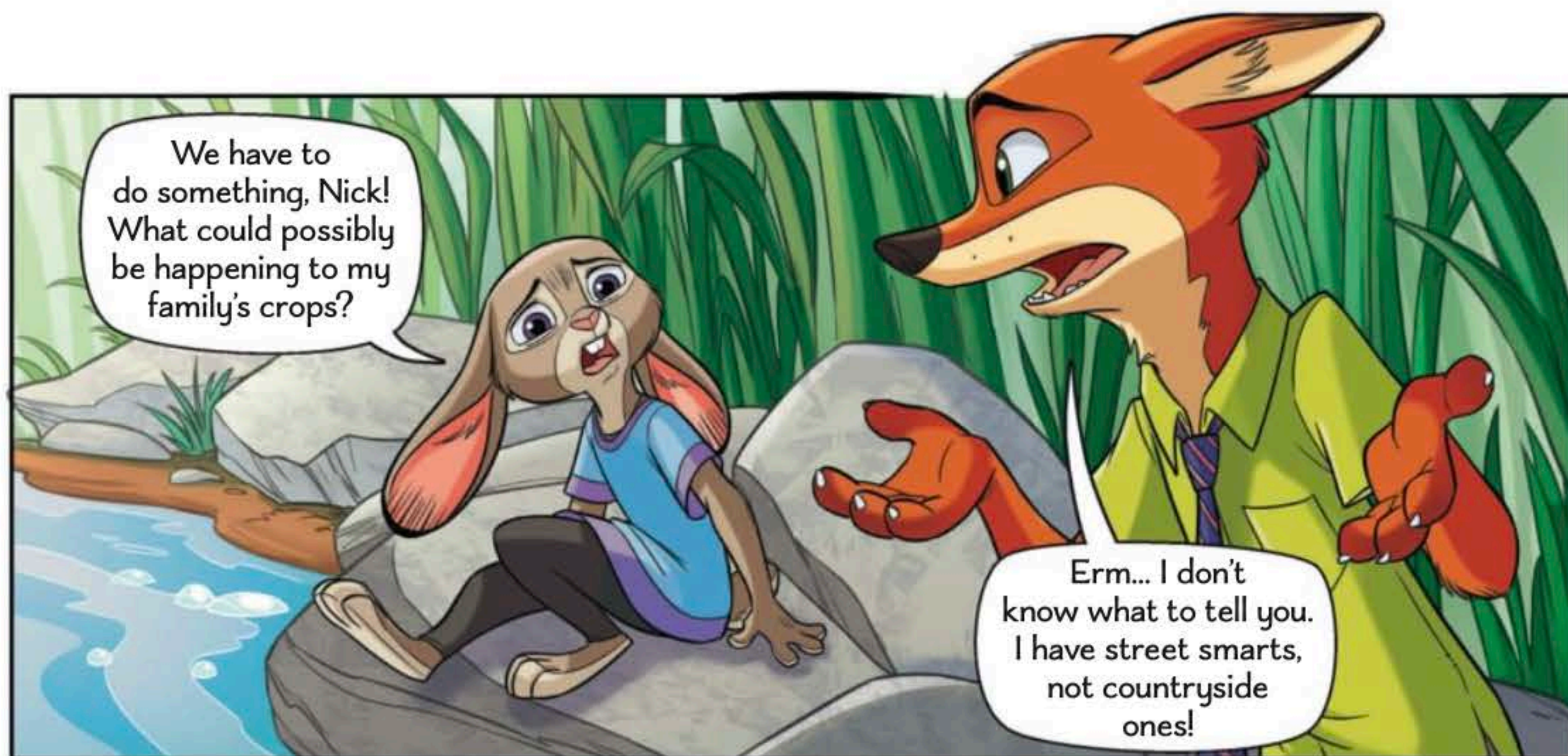
I must do something about it!

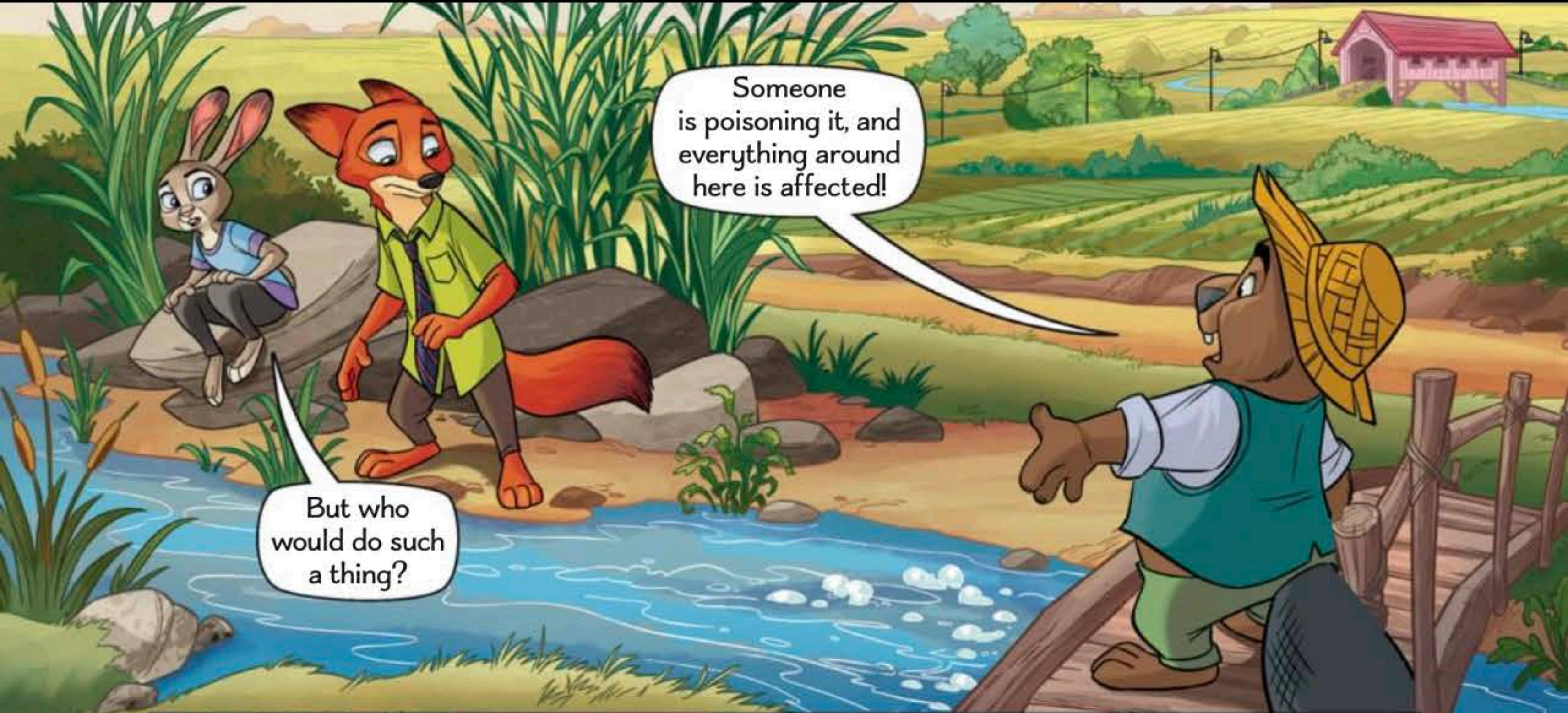
Huh, Carrots?



Hey, Judy, what's going on?

It's just... I didn't think I would find trouble right here in my hometown!





Someone is poisoning it, and everything around here is affected!

But who would do such a thing?



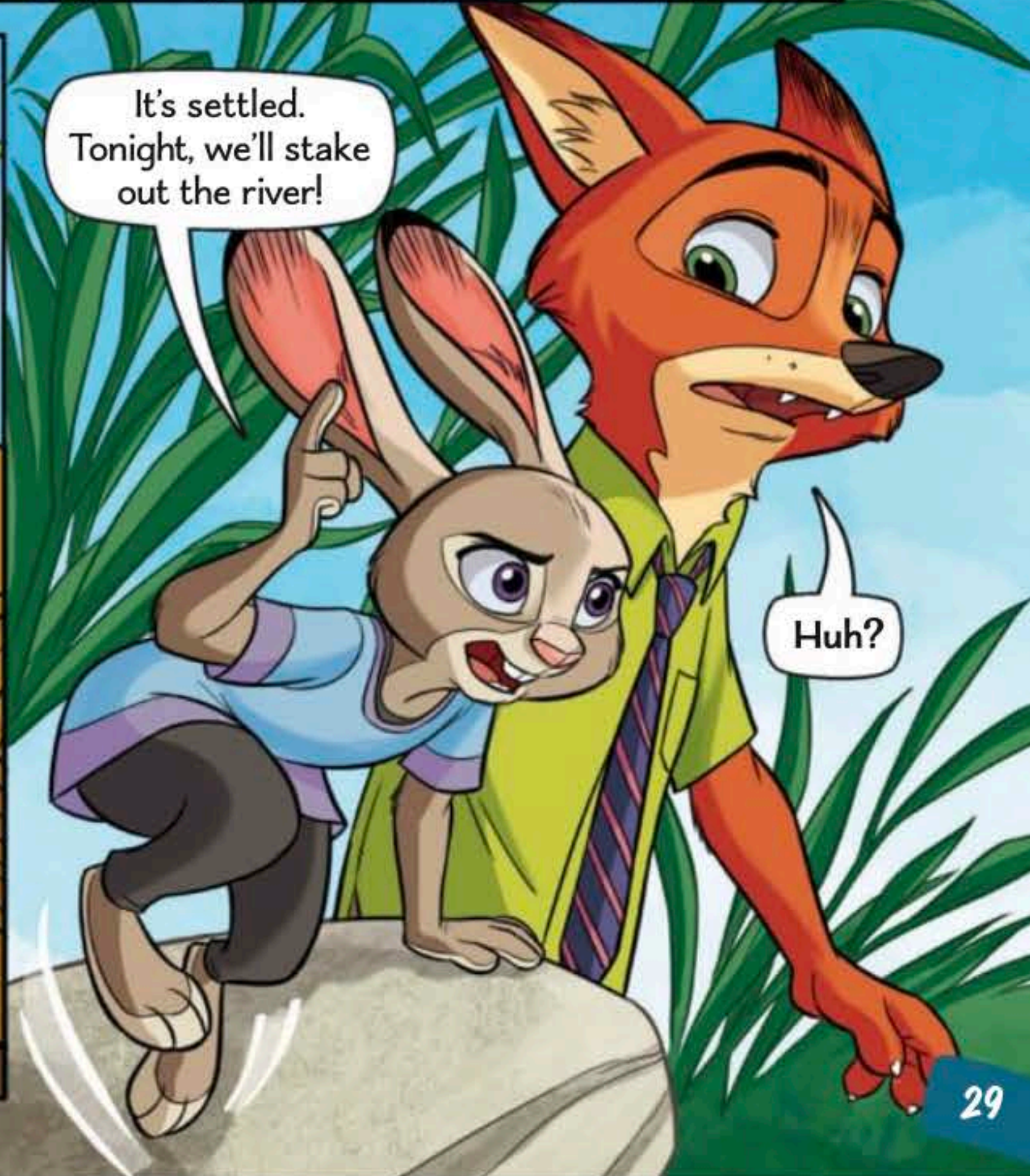
Oh, for a while now there's been some strange comings and goings around here at night... Strange trucks near the covered bridge, dumping stuff in the river, if you catch my drift...



"Strange trucks"?

Unfortunately, no one believes me!

Hmmm...



It's settled. Tonight, we'll stake out the river!

Huh?

Later that night...

I really don't know what's got into you, Carrots! Weren't we supposed to come here on vacation?

I want to know what's going on with Bunnyburrow's crops, Nick!



MONOCULTURES AND INTENSIVE FARMING

- The beginning of farming
- GMOs in farming
- Local farming

The beginning of farming



THE FIRST SEED

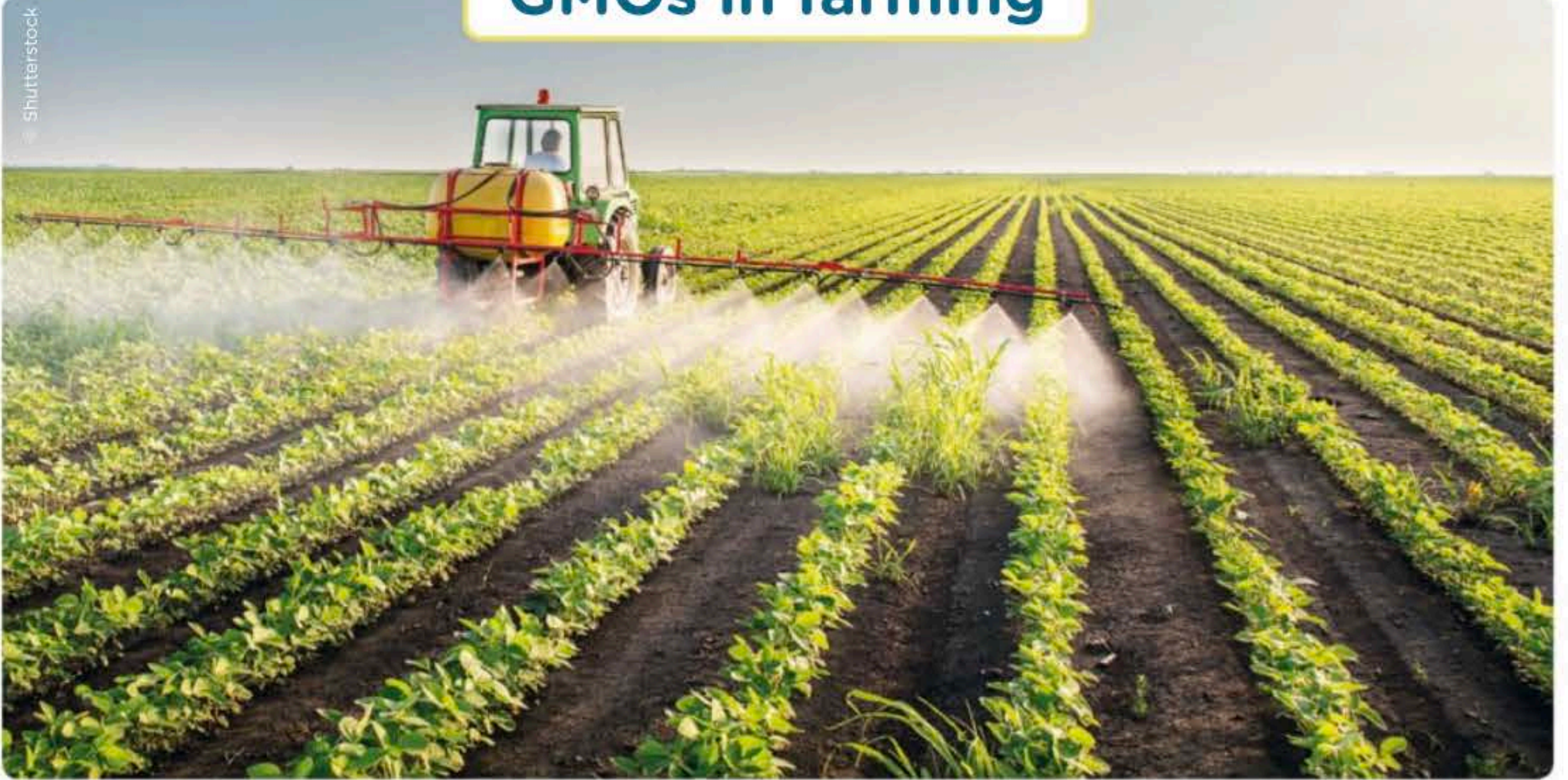
The development of agriculture, about 12,000 years ago, changed the way humans lived. They switched from nomadic hunter-gatherer lifestyles to permanent settlements and farming, and started planting seeds in favorable locations in order to grow them and eat plants. This is how rural communities were formed: groups of farmers who learned how

to choose and use the best seeds. They also taught what they knew to their children, who in turn discovered other seeds, and so on, allowing humans to grow many different species of plants. And the more the species differ from each other, the higher the chances that some of them will have the characteristics to adjust to and survive changes in the environment. This variety of plant and animal species is part of **biodiversity**.



← Biodiversity doesn't refer just to the variety of living organisms, but also to that of the environments they live in.

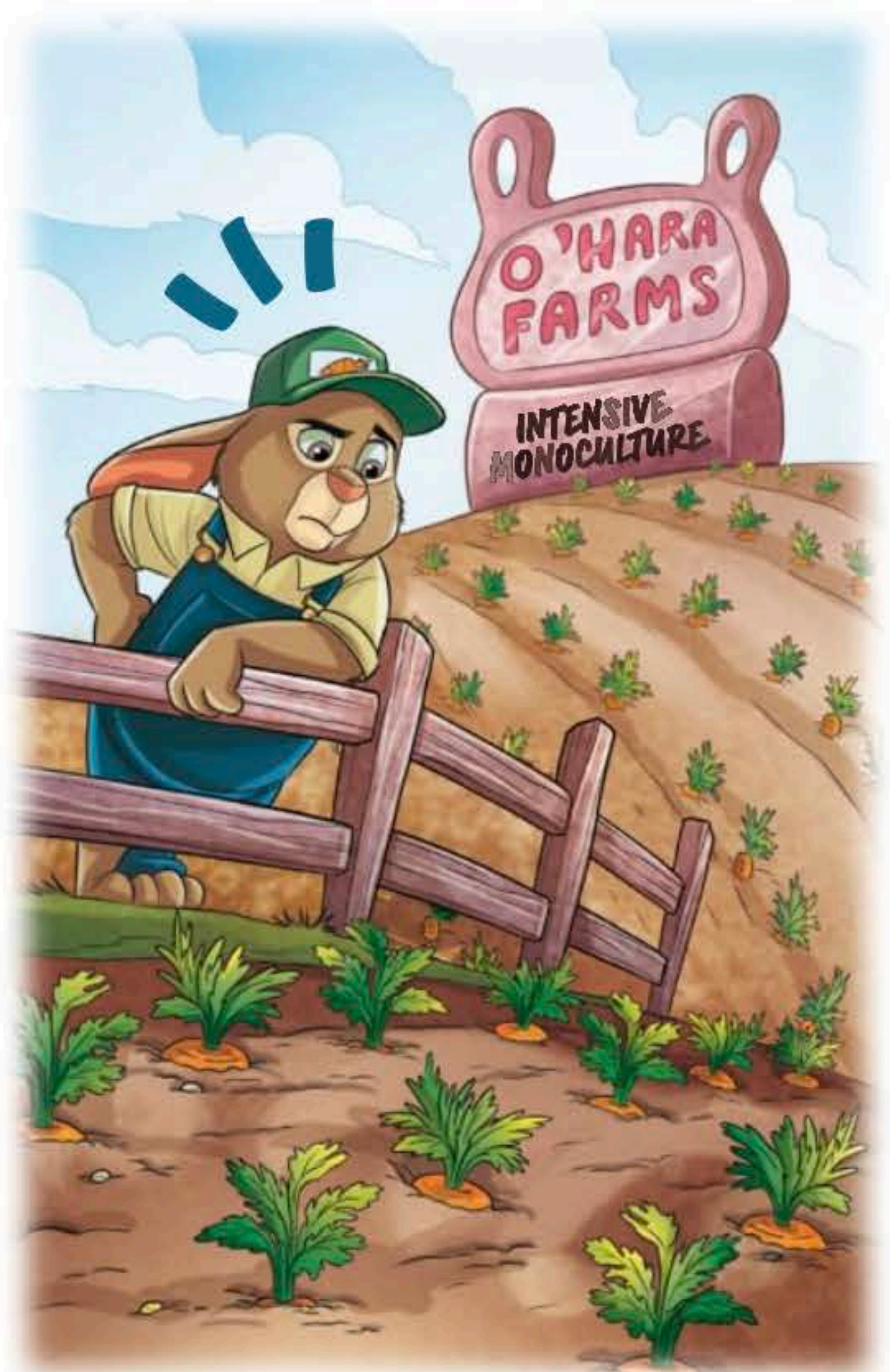
GMOs in farming

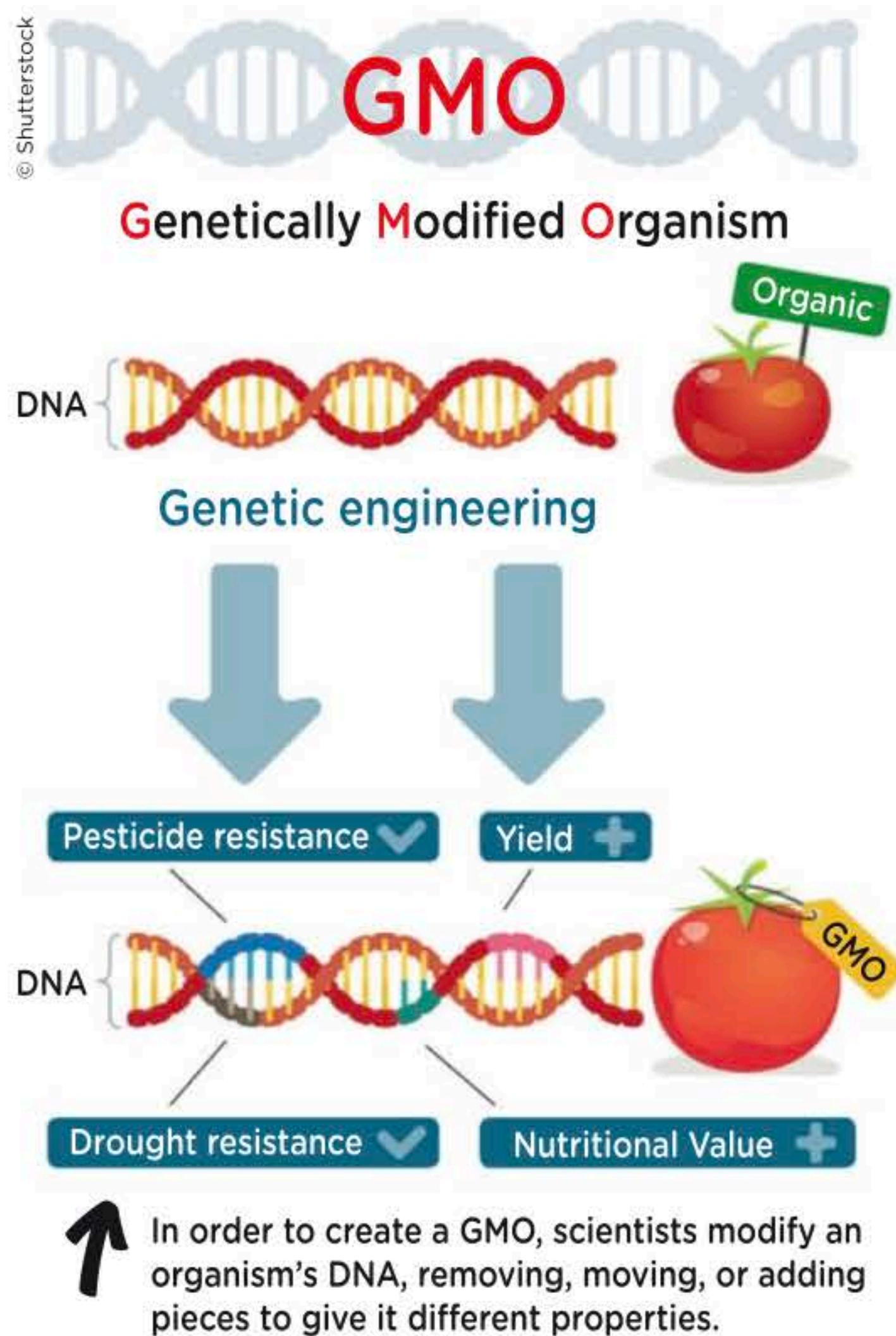


WHAT IS MONOCULTURE?

The purpose of agriculture is to farm the land and obtain food. A great variety of plants can be grown one after the other in the same soil, being alternated throughout the year, but it's also possible to plant just a few species, or even a single one. This latter type of farming is called **monoculture**. It is often done intensively, meaning farmers exploit the land to the fullest to grow as many plants as possible within a limited area. Unfortunately, growing just one or a few types of seeds on a large scale takes a lot of space and resources away from other plant species, and can cause their disappearance, as well as that of the animals that rely on those plants to survive. Furthermore, intensive farming deprives the soil of its elements, requiring the need to use **larger quantities of chemicals** like fertilizers to add nutrients, and pesticides to tackle plant diseases, which can pollute the soil and water.

↑ As more land is farmed as monocultures, the number of natural environments that are home to a diversity of plants and animals decreases.





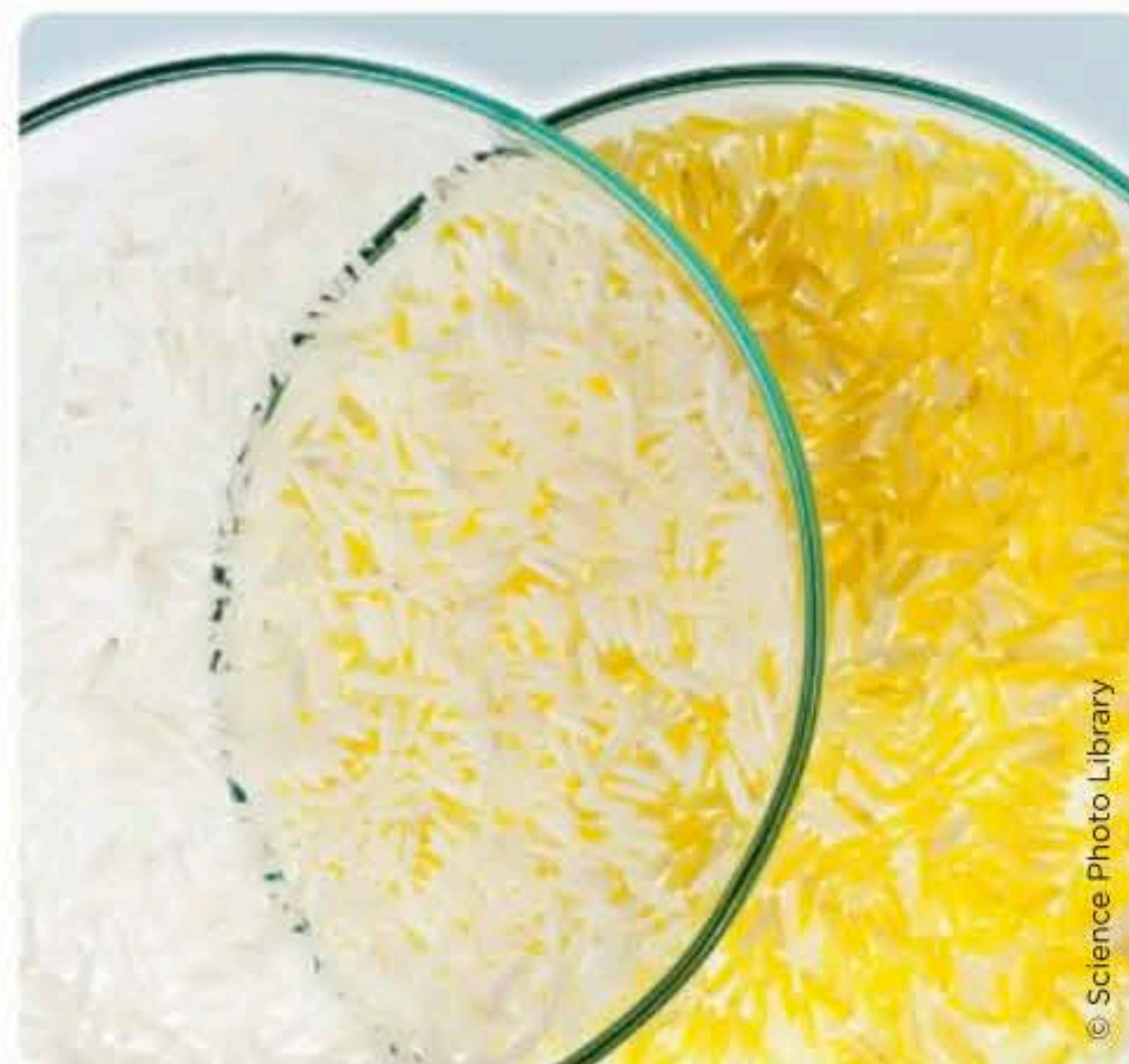
WHAT ARE GMOS?

Technological advances have allowed more crops to be grown using fewer chemicals. **GMOs** are one example. They are genetically modified organisms, meaning that changes have been made to their **DNA**, a molecule that carries an organism's **genetic blueprint**. In other words, DNA contains all the information required to build and maintain an organism. These changes cause GMO plants to produce slightly different fruits from the ones found in nature. They might be more resistant to diseases or even ripen more slowly so less harvest is wasted. GMOs are considered safe to eat, but longer-term effects on humans' health still need to be fully studied.

TOGETHER FOR BIODIVERSITY

GMOs can be more enduring than organisms found in nature. As such, they are widely used in intensive monocultures because they allow the production of large amounts of food, which will be enough to meet the needs of the current global population. What's more, certain plants are also modified to withstand heat so the same land can continue to be farmed even when the climate changes. However, these new crops can lead to the disappearance of **traditional seeds**, which are much more delicate and difficult to grow than genetically modified ones.

Along with the traditional seeds, those who grow them could also disappear: the small communities of farmers who have handed down a form of agriculture where different crops are alternated. So what can we do to avoid losing biodiversity? We can use GMO seeds while also making sure not to completely eliminate traditional ones.



↑ GMOs can also have health benefits: genetically modified Golden Rice is a type of rice that is more nutritious for humans than standard white rice.

Local farming

SUSTAINABLE PRODUCTION

These days, farmers face a very important challenge: to produce food while respecting the planet and its biodiversity. This is possible by using a sustainable form of production, that is, by producing food in a way that respects nature more than farming practices generally do. Small family-run farms tend to do this more often, because they know well the land they farm and hand down their experience from parent to child. However, in order to make a difference, it is important for everyone, especially large farms, to switch to sustainable forms of production.

Indeed, farmers should always respect the land and know when it should "rest" or when new seeds can be planted. **Organic**—meaning "only natural"—farming methods should be used as often as possible to allow the soil to become more fertile and to control parasites. Finally, farmers

should waste as little of the crop as possible, for example, by using the parts of the plants that aren't eaten to make fertilizer. Such good practices help reduce waste and should be put in place by all farms to preserve the environment and its biodiversity.



One of the benefits of family farming is the opportunity to hand down knowledge from parent to child. This can lead new generations to farm more productively and waste fewer resources.



WHO'S DUMPING WHAT?



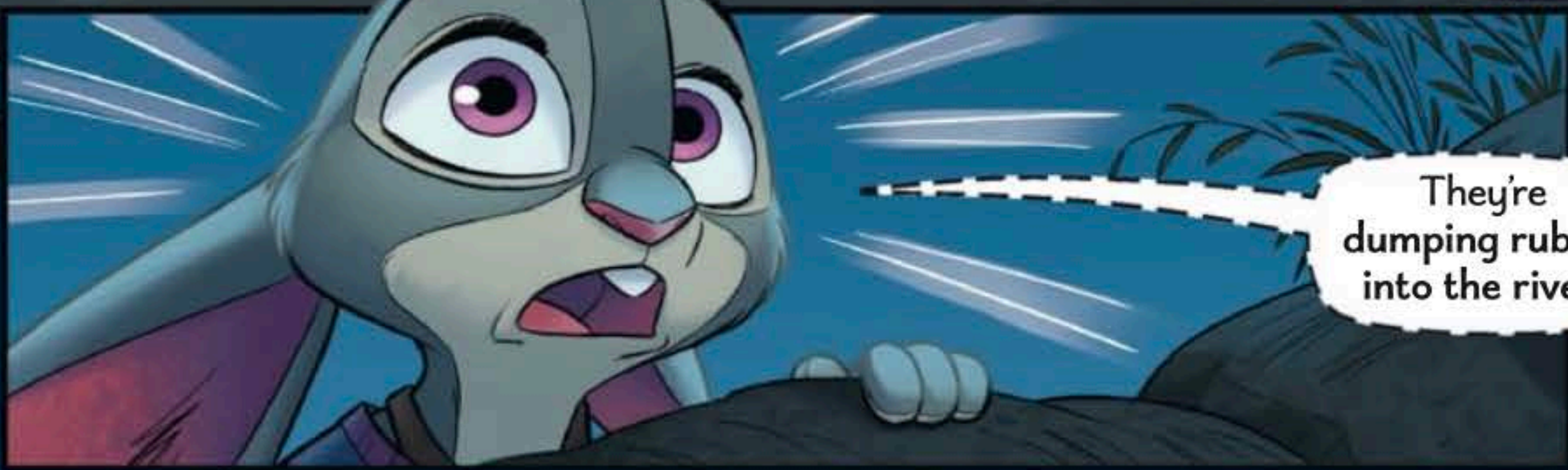
Okay, I admit
it, you were right!
Something shady
is going on!

That's for sure!
What's a dump truck
doing out here... and
in the middle of
the night?

VRRROOOOM

KA-KLUNK
RUMBLEE
SPLASH

Whoops,
guess there's
your answer!



They're
dumping rubble
into the river!



I bet it's totally
illegal.



You
can say that
again!

HEY,
YOU!



I'm Agent Hopps of the ZPD! Everybody in there, freeze!

Darn! There are cops?!

Never seen any 'round here before!

The boss promised us there wouldn't be a living soul on the river at night!

And yet, Stripe, those sure aren't ghosts, are they?

I can change that, Dottie!



Don't you dare move an inch, Rings, you fool! The boss told us not to attract attention!

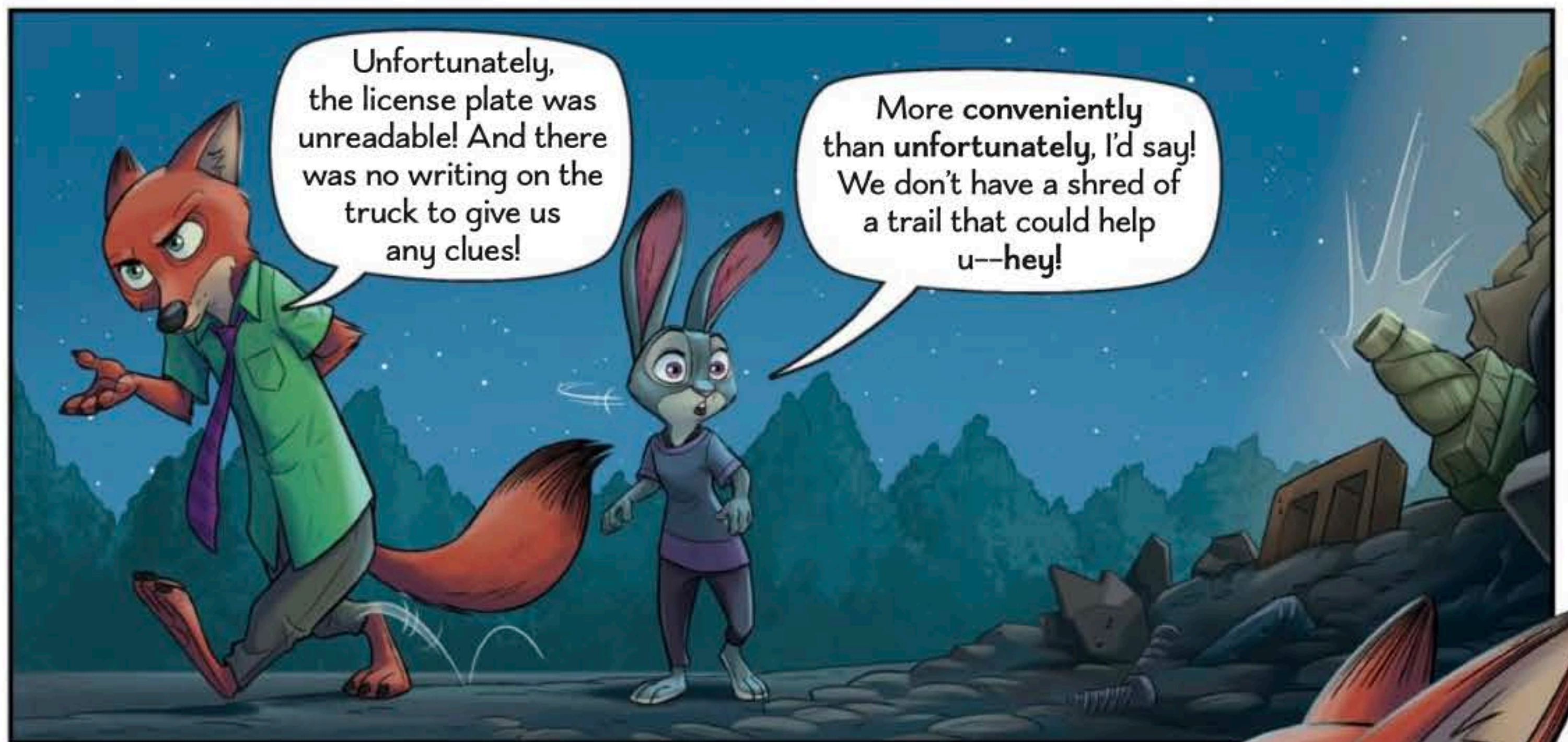
Okay, okay, there's no need to shout.

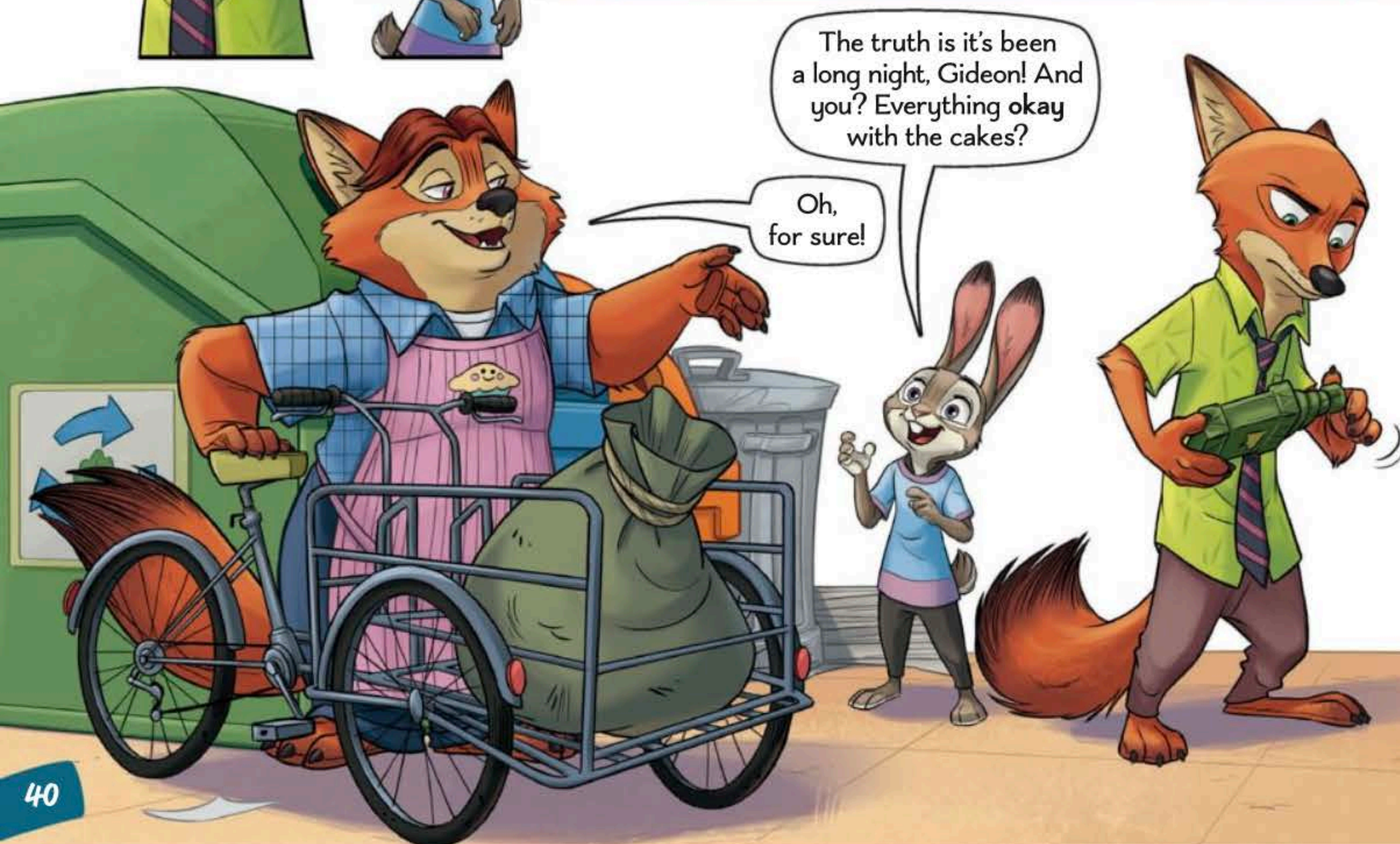


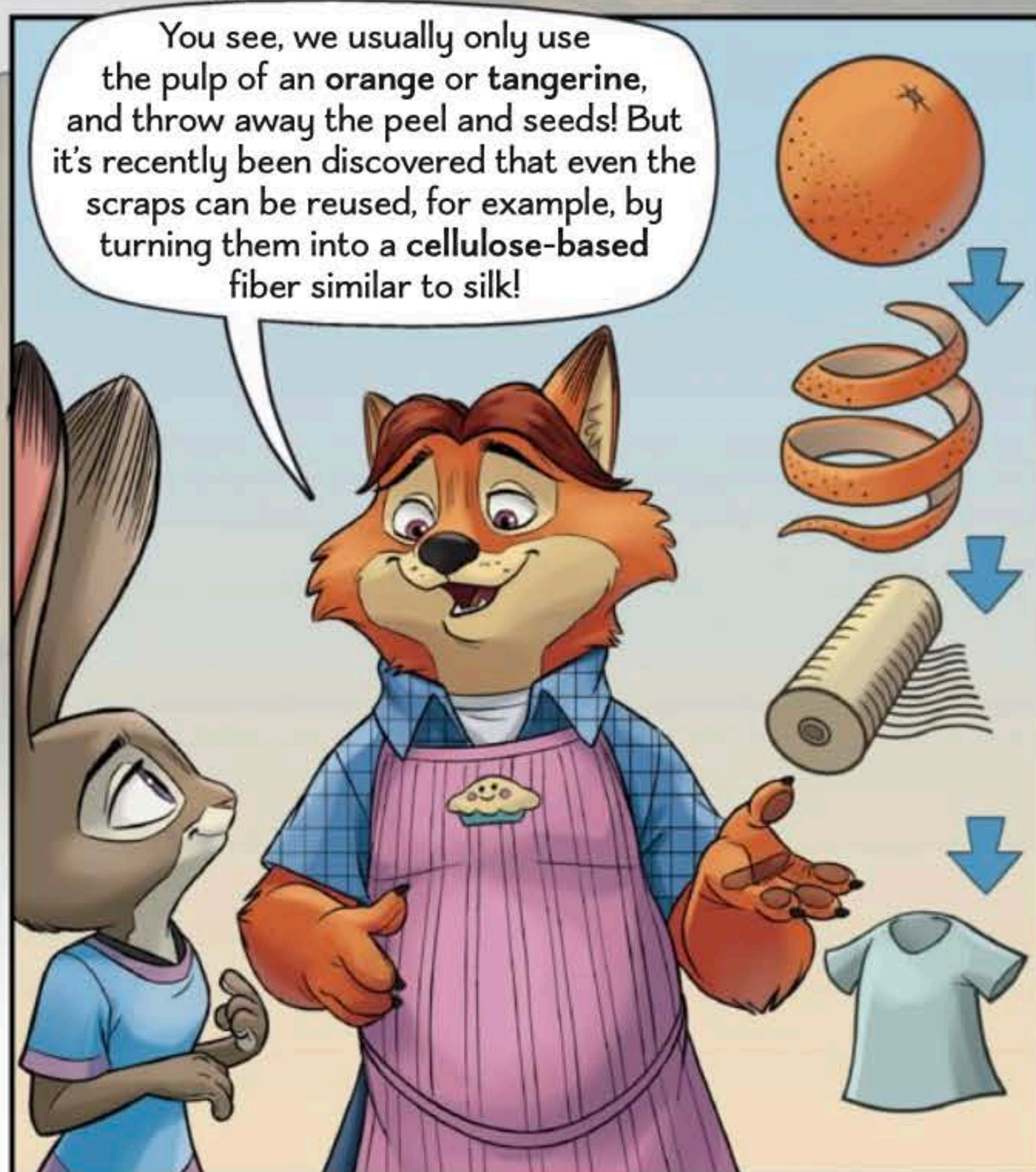
So what do we do?

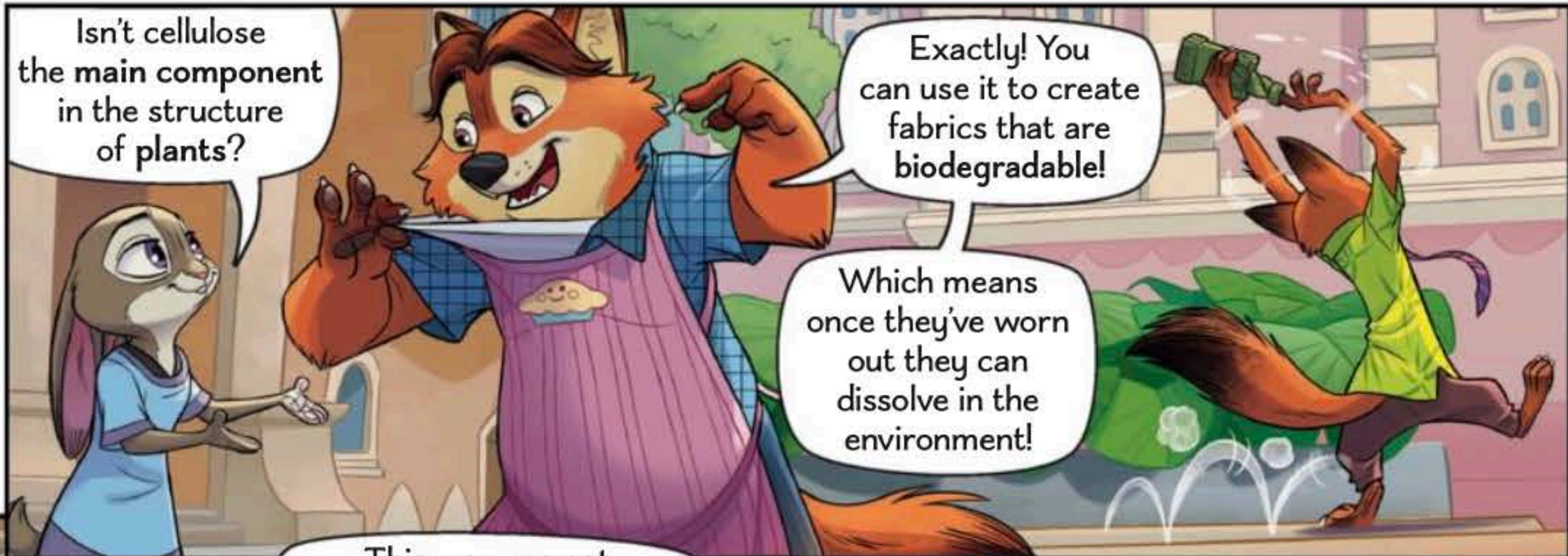
THIS!













Isn't cellulose the main component in the structure of plants?

Exactly! You can use it to create fabrics that are biodegradable!

Which means once they've worn out they can dissolve in the environment!




This way, we not only reduce waste, we also produce less of it to pollute the environment! And that's not all, by the way!



In these jars is the oil I used to fry my funnel cakes.

I think it was actually your folks who explained it to me: oil that's been used for frying can't be thrown away, not down the drains or on the ground!



Dumping oil in the environment is very serious. The oil covers everything with a film that prevents oxygen from circulating, both in water and on land!

So I bring it here, where it's collected to be reused to produce something else useful, such as soap, biodiesel, lubricants, biogas, and pitch for roads!

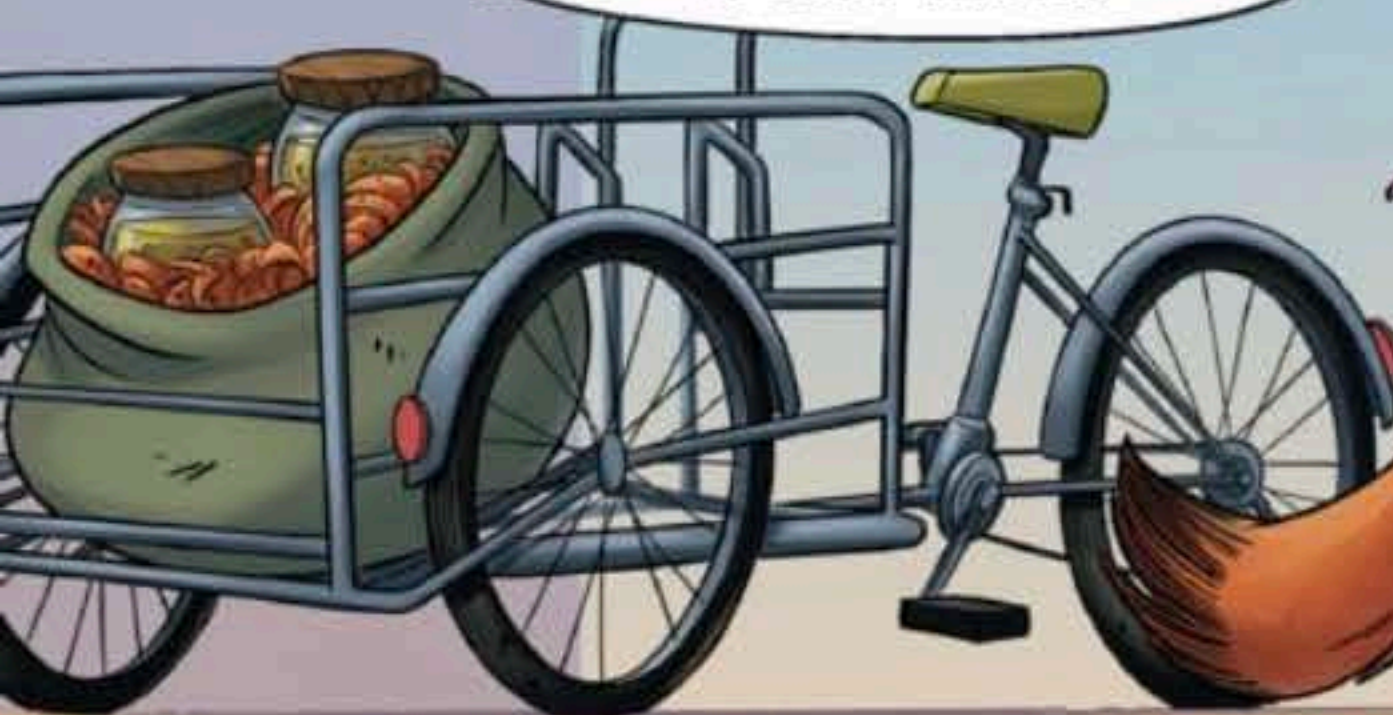


And speaking of roads: even the tricycle I use to bring my rubbish here is made of aluminum made from recycled cans!



It's all very interesting, Gideon, but...

In other words, Judy, most waste can be used again, with materials and by-products staying in use longer and thus reducing the production of other waste.



I understand, but we have a lot to do...





I got my finger free, finally!

About time! I noticed you've been quite busy with that bottle...

Heh... I was just, err... checking it for clues?

Glad to hear it, because I was under the impression that you were fumbling with what may be the only piece of evidence available.

Heh. Don't worry, Carrots!

Erm, people. Speaking of your bottle...

Where did it go?

CONTINUES ON PAGE 49



THE WORLD OF WASTE

- Municipal and industrial waste
- Landfills
- Collecting and recycling
- Waste-to-energy plants

Municipal and industrial waste

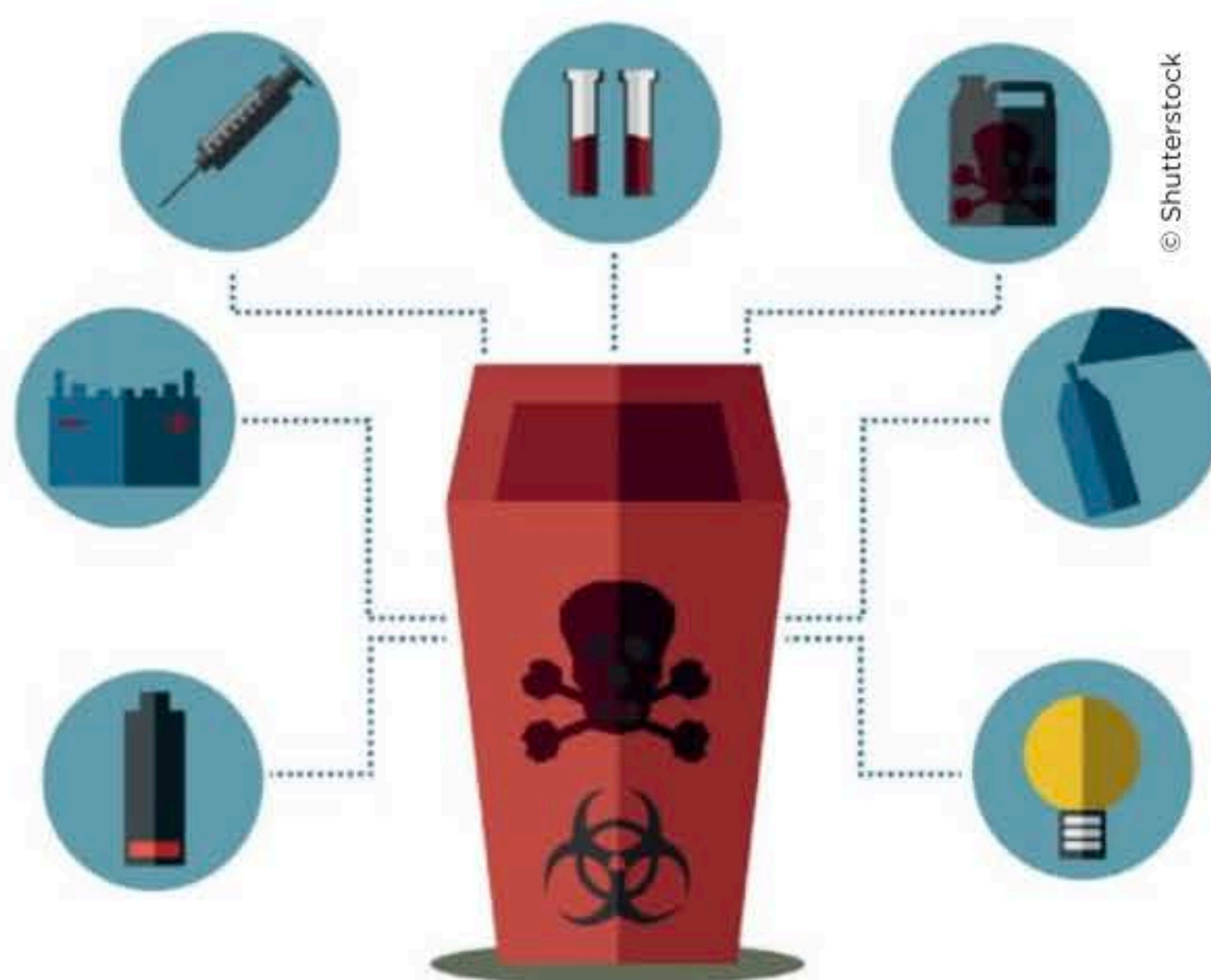
DIFFERENT TYPES OF WASTE

Every time people throw things away, **waste** is produced, such as leftover food, clothes, and old or broken domestic appliances. This type of waste is called **solid**, as it consists of objects, and **municipal**, because it is produced by people in their day-to-day life.

The waste generated by industries and commercial activities, such as stores and restaurants, on the other hand, is called **industrial**.

All the waste is collected and taken to **landfills**, which are places where the waste decomposes or is burned. However waste can also be washed and reused in different ways.

The important thing is to make sure it isn't left in the environment to pollute it.



↑ Among others, medicines, batteries, and paints must be disposed of in special containers because they are household hazardous waste (HHW).

Landfills

WHERE DOES WASTE END UP?

All **municipal solid waste**, also known as MSW, that isn't sorted ends up in a landfill. This is an open-air site, usually located on the edge of the city, where waste is accumulated in a hole or piled in a heap. Here, upon contact with the oxygen in the air and the elements—like rain, snow, and sun—waste breaks down into ever-smaller pieces until it dissipates into the environment.

But not all waste disappears at the same rate. Some types **decompose** more quickly, like paper tissues, which take from three to six months. Others take longer: aluminum from a can, for example, can take between ten and a hundred years, while the plastic from a bottle can remain in the ground of the landfill in the form of tiny pieces even after hundreds of years! And during all those years, the plastic pollutes the ground around it, damaging the environment. But that's not all: as the waste in the landfill decomposes over time, it produces carbon dioxide and methane, which are both gases that let less heat leave the planet, thus causing temperature to rise and contributing to climate change.



Waste decomposes at different rates. Glass can take over a thousand years!



FOOD
WASTE
About
1 month



PAPER AND
CARDBOARD
1 to 3
months



TEXTILE
Up to
2 to 3 years



RUBBER
30 to 40
years



METAL
10 to 500
years



PLASTIC
More than
500 years



GLASS
More than
1,000 years

Collecting and recycling



WASTE SORTING

If you live in a country that recycles, it is very important to follow the rules for sorting waste when disposing of it: basically, each material should be put with other similar materials. For example, cans and some other containers, like those used for ground coffee, are made of aluminum and so should be disposed of in the same bin, to be processed together. Sorting the waste by the materials it's made of is the first step in enabling it to be **recycled**.

Recycling works like this: the people who take the waste away, the trash collectors, separate what is in good enough condition to be reused from what isn't. The selected waste is then washed and shredded into small pieces so it can be transformed into something else. When waste is recycled, new objects can be produced using the same materials, therefore wasting less resources.

What's more, recycling helps keep the environment cleaner. The most commonly recycled materials are paper, plastic, aluminum, and glass, but they're not the only ones. Nowadays, some wet waste, such as orange and apple peels, can also be treated to produce sustainable fabrics, which can be used to create clothes, bags, and even shoes.



© Shutterstock

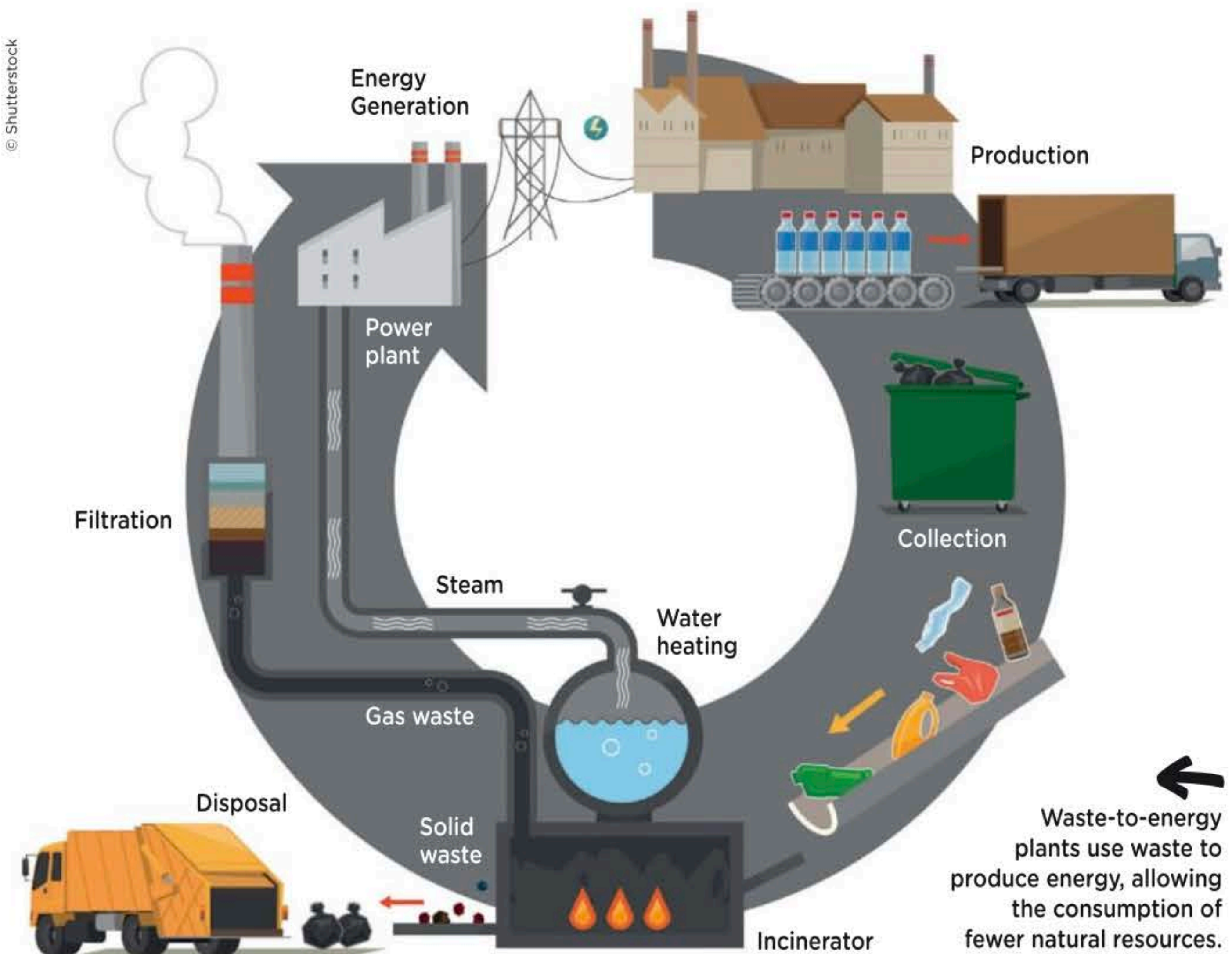
➤ After they've been read, newspapers, books, and so on can be disposed of in special bins ready for recycling. They are then effectively transformed into new paper in specialized factories. And this paper can become a new book or notebook, beginning the cycle again.

Waste-to-energy plants

EVEN WASTE IS USEFUL

Unsorted municipal solid waste may be taken to a landfill, but it can also be burned in a **waste-to-energy plant**, a place where waste is converted into energy for people to use. Here, the waste is tipped into a giant tank, where it is mixed. Then a kind of escalator transports it to a high-temperature furnace called an **incinerator**. While it is being burned, the waste produces fumes that contain pollutants. Because of this, the fumes are treated—meaning they're cleaned so they don't pollute the air—before being released through a chimney.

To improve the process, the waste can be presorted to separate materials that are easily burned from those that aren't. When the waste is burned, it generates a **large amount of heat**, which heats the water contained in special pipes. When the water is hot enough, it turns into **steam**, meaning that it changes from a liquid to a gaseous state. The resulting steam generates electrical energy via a rotating mechanism called a **turbine**, which transforms the movement of a **fluid** (a liquid or a gas) into energy. Furthermore, it is increasingly common for part of this steam to be sent directly to houses' heating systems as ready-to-use thermal energy!

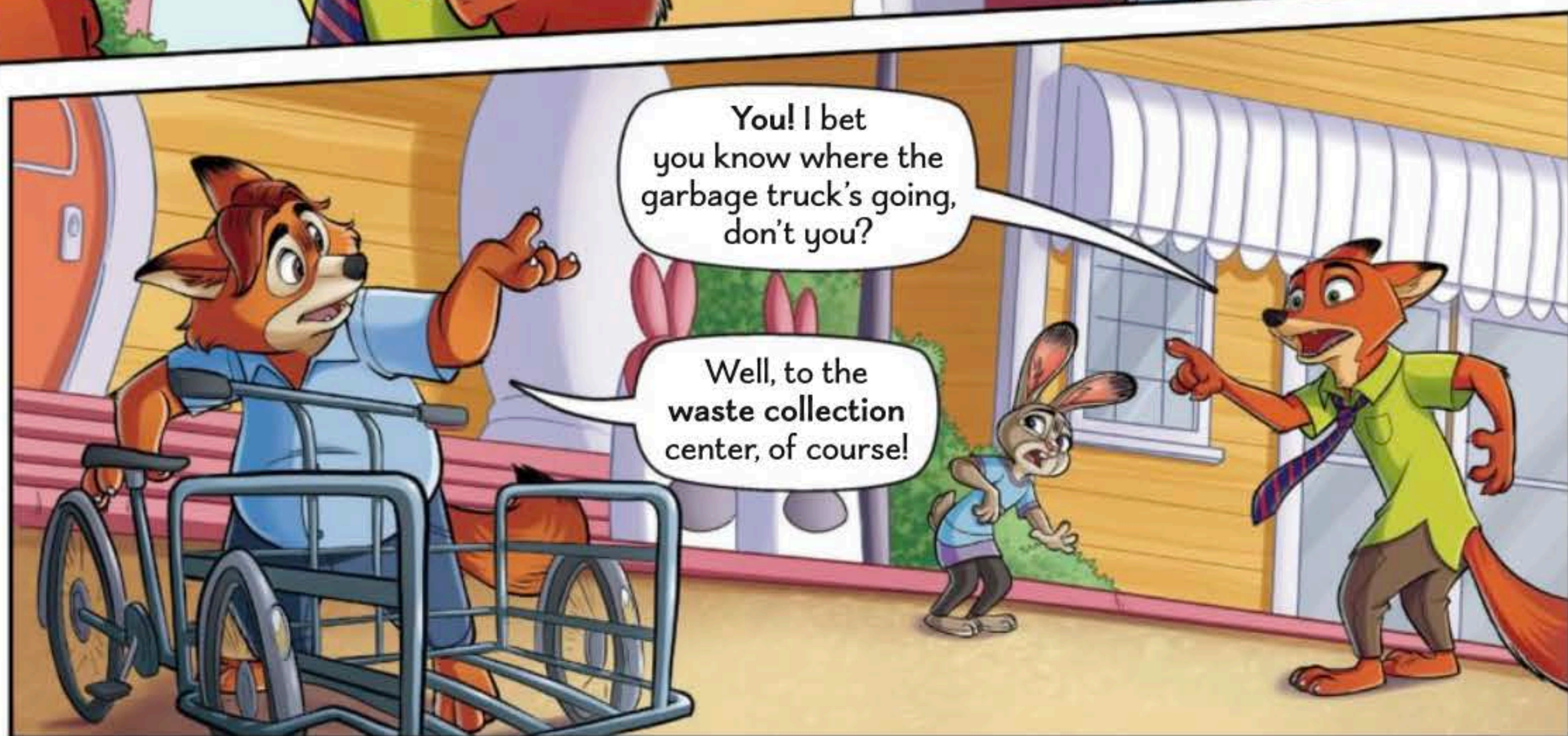
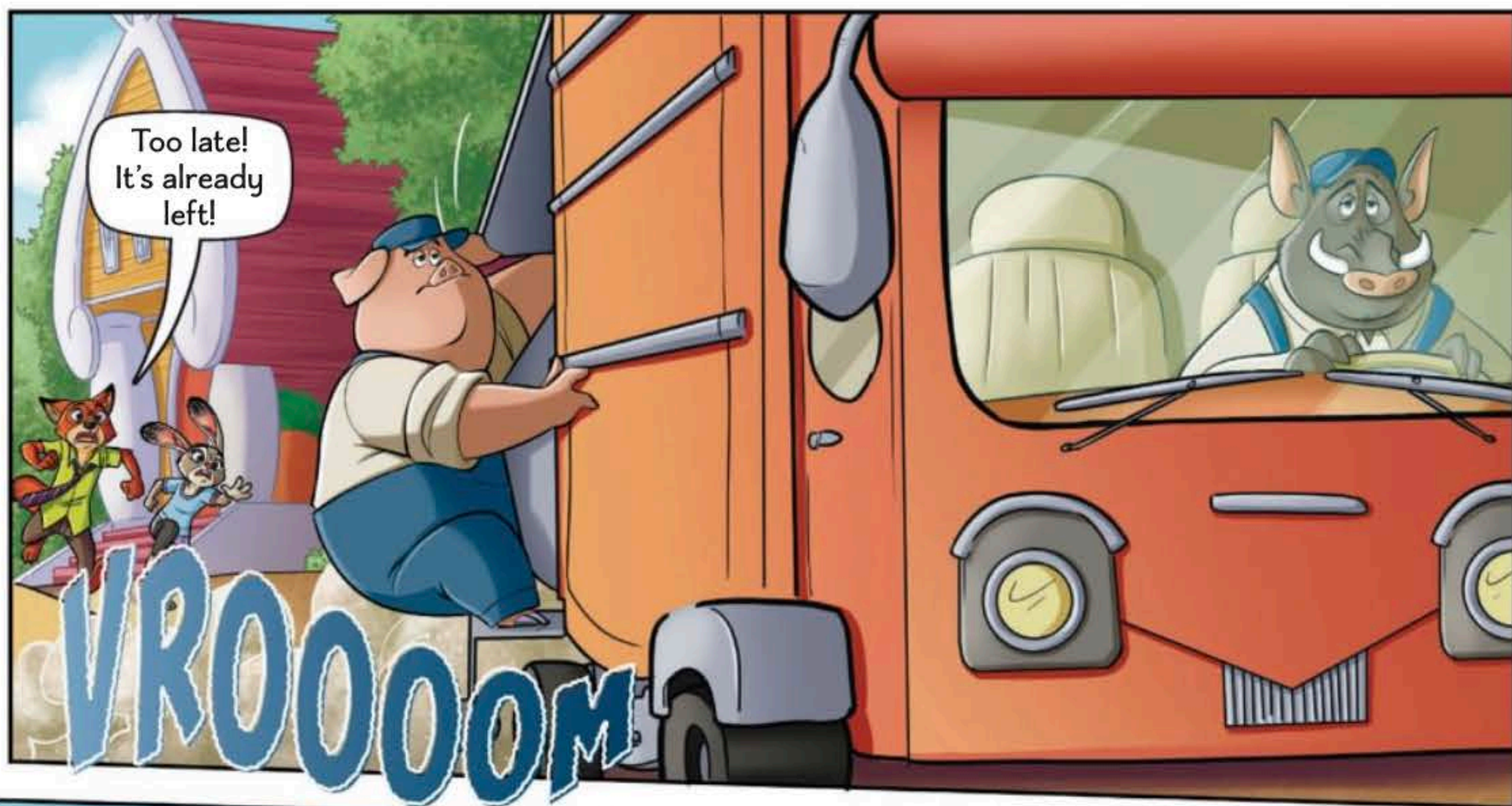


**DON'T LOSE
YOUR BOTTLE!**



The trash
collectors have just
taken your bottle
along with my
stuff!

Oh, no!
We have to
get it back!





And where is it?

Just outta town. It's not far...

Gideon, we have a favor to ask you...

Yahoo! Come on, Nick, we've almost caught up!

Pant! It's that "almost" that worries me! I don't know how much longer I can keep this speed up.

WHIRRRRR



C'mon, you can do it! Imagine you're on bike patrol!

≡Pant, pant!≡
Easy for you to say!
You're not the one pedaling!



Not much longer, Nick! We're here!

≡Puff!≡ About time! Now we can get the bottle back.



Maybe it won't be as easy as we thought!

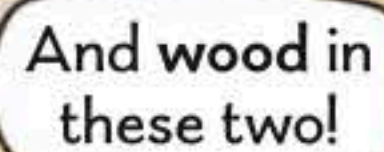
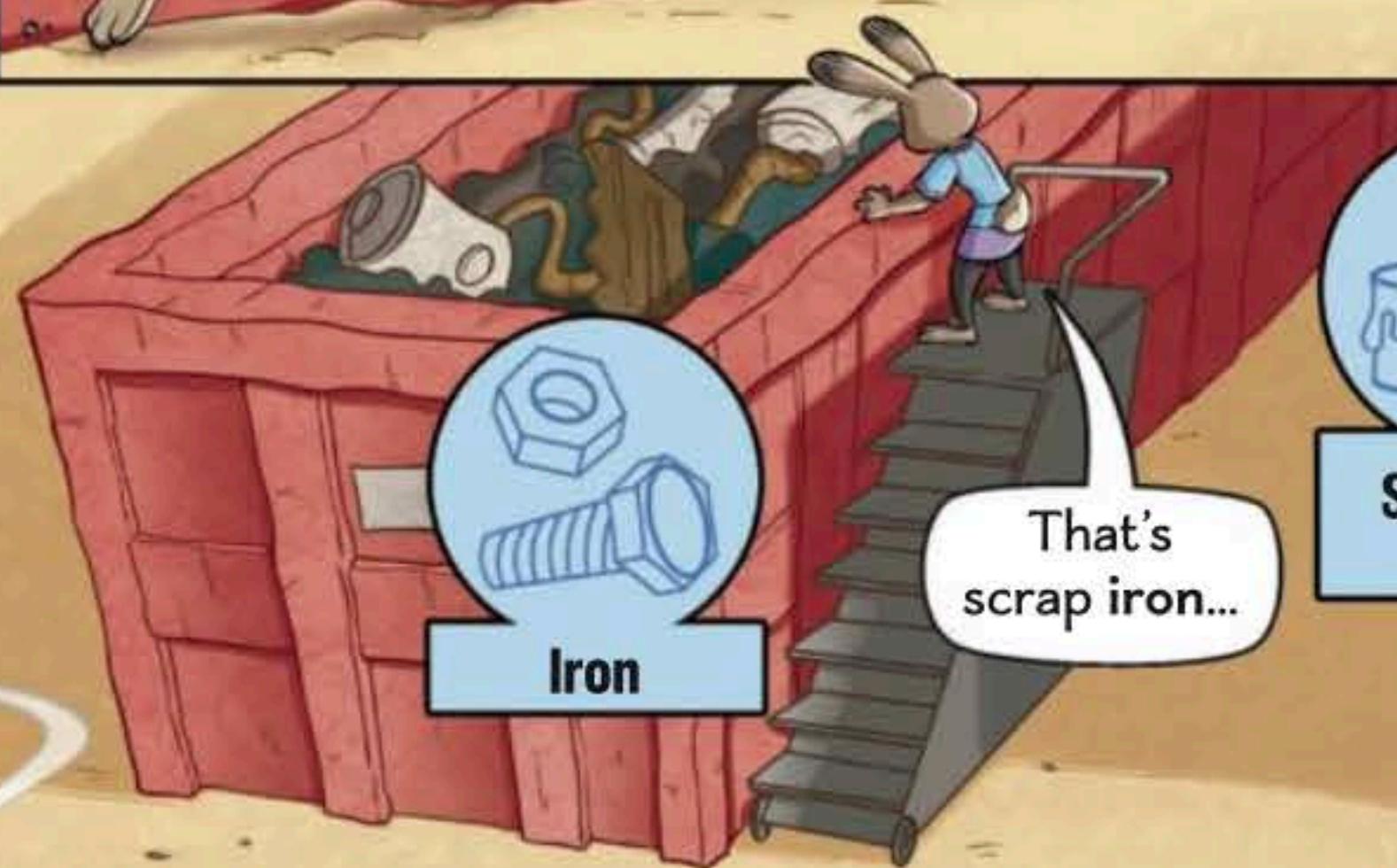
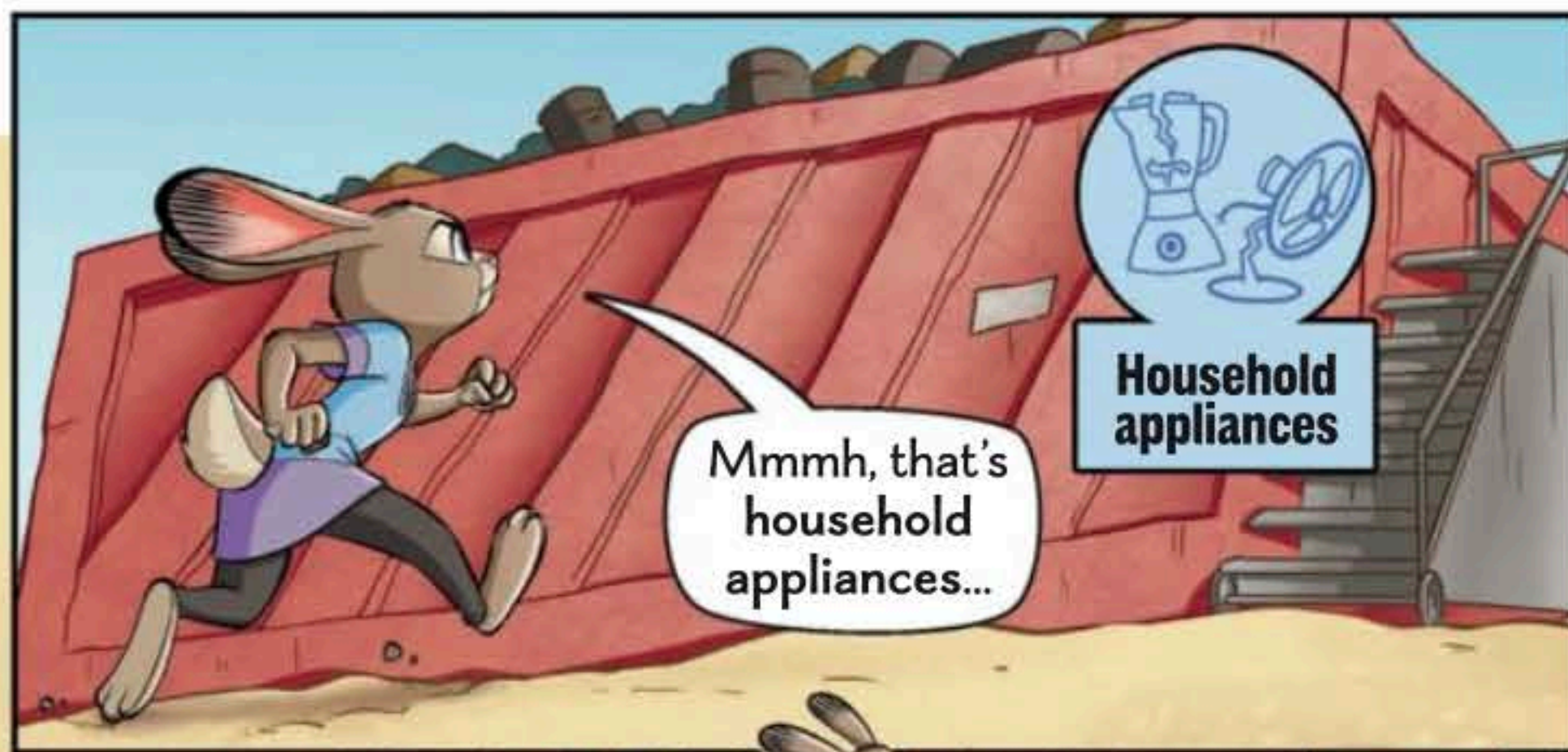


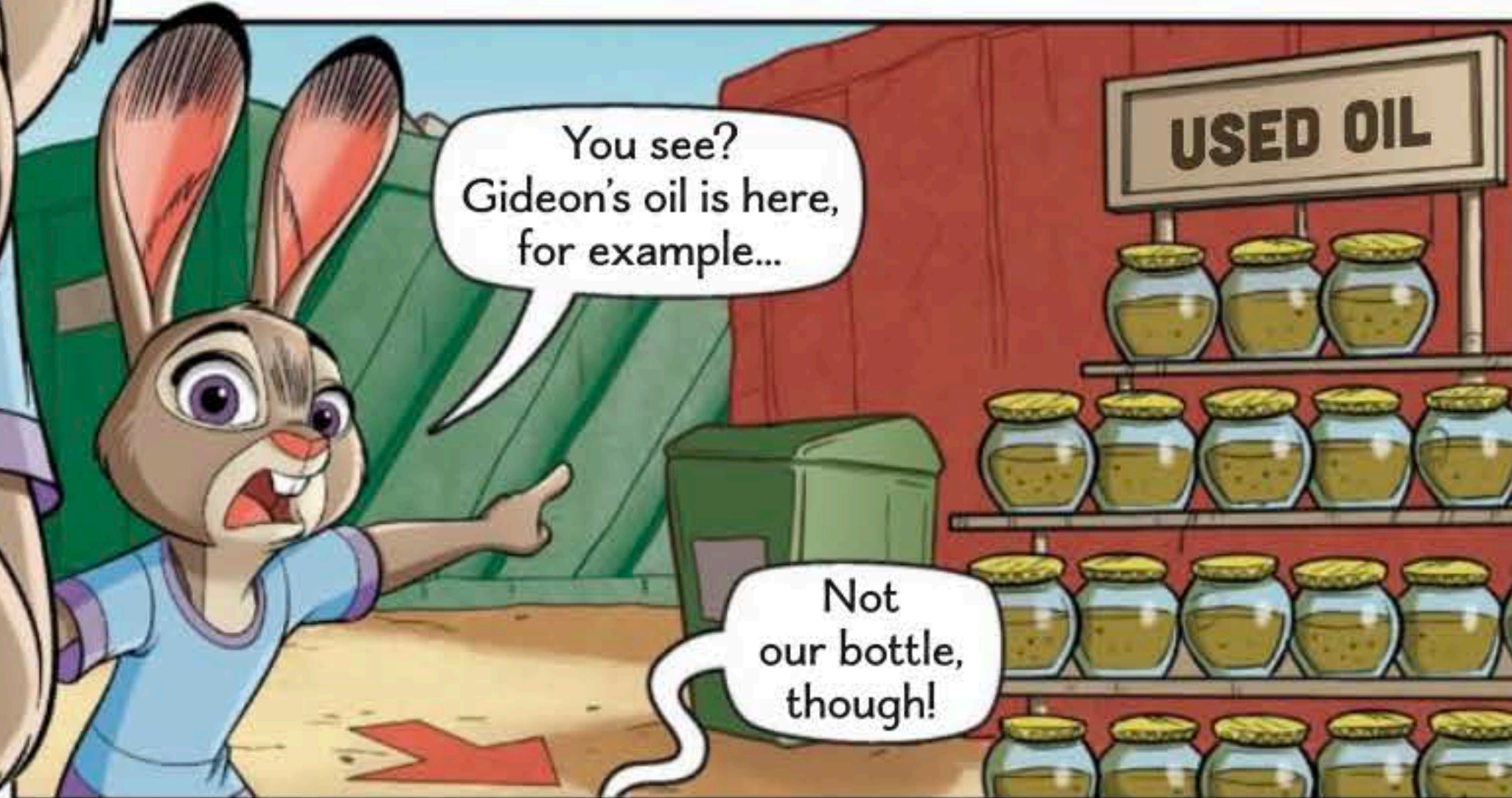
It's gonna be like looking for a needle in a haystack!

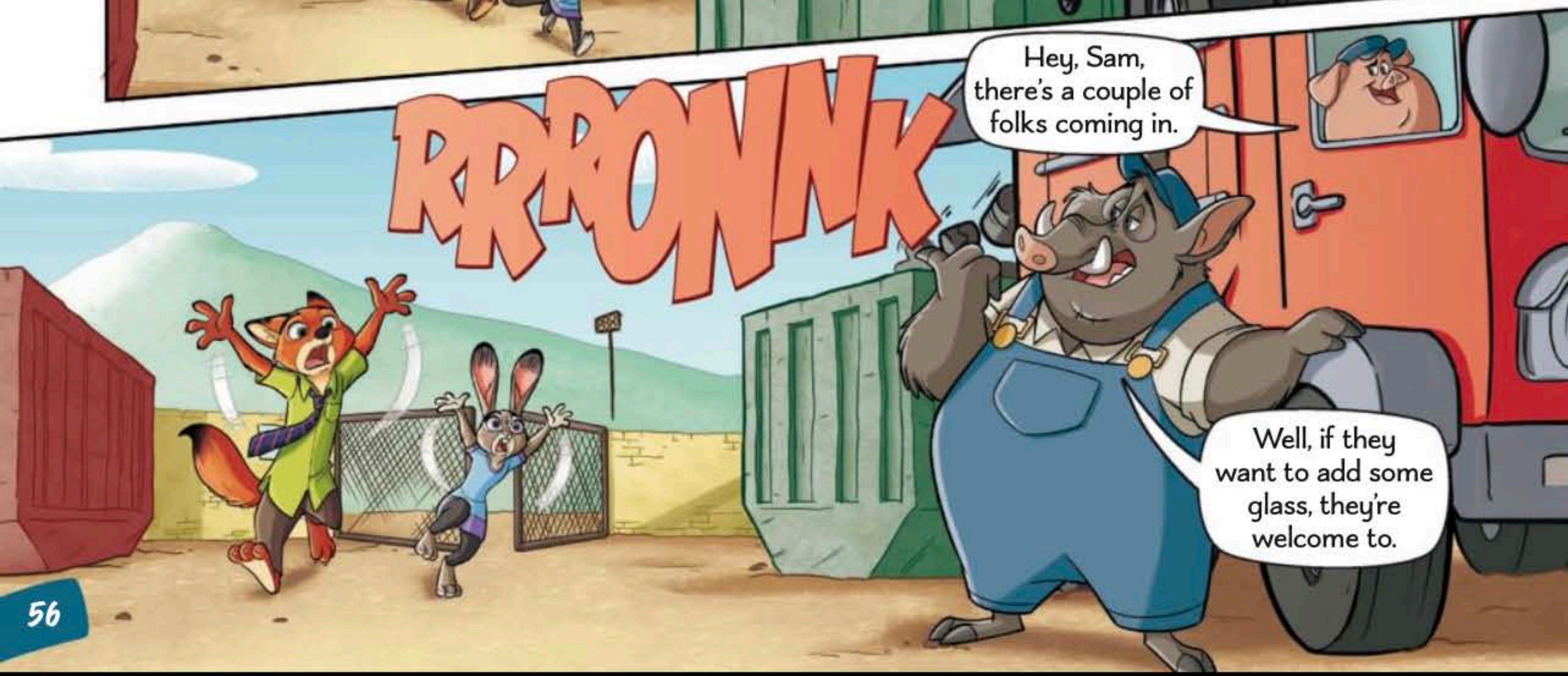


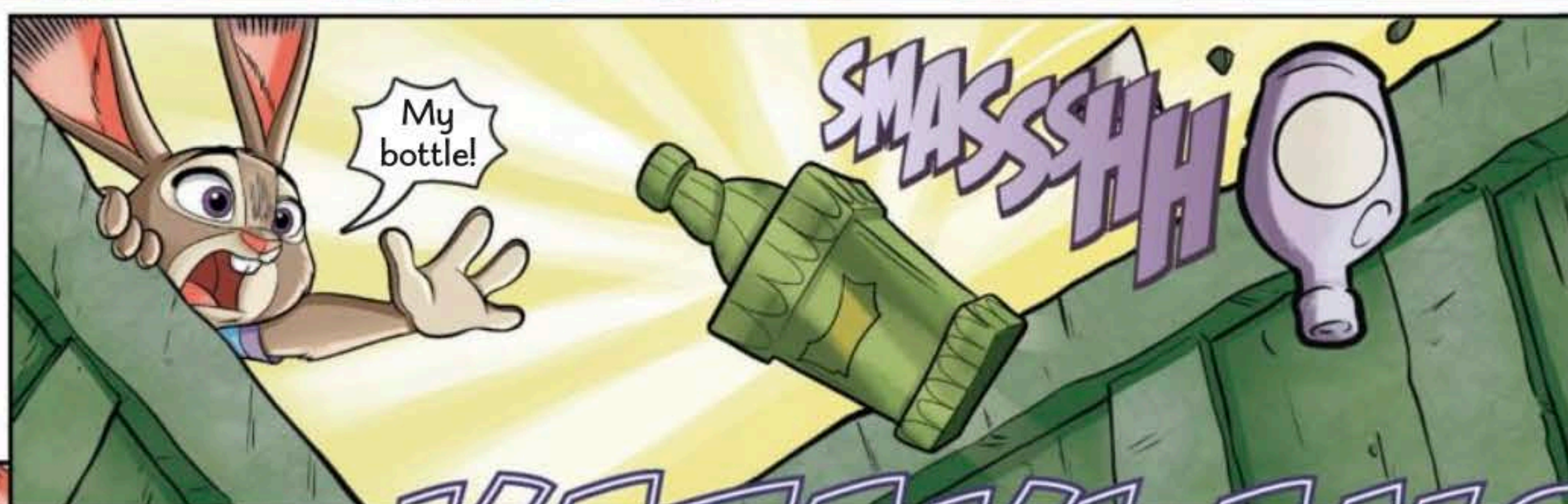
We can do it!

You think?









But the following day it's already time to go back to Zootopia...



CONTINUES ON PAGE 63

RECYCLING CENTERS AND REDUCING WASTE

- Recycling centers
- Recovering objects
- Packaging or no packaging?

Recycling centers

A NEW LIFE!

Trash collectors take the sorted waste to places called **recycling centers**. Citizens can also take certain types of waste there, for example, objects that are too large for the household garbage or hazardous ones. At the recycling centers, the waste is separated and then sent to materials recovery facilities, where it is washed and recycled. This enables the waste to have a second life and be transformed into something else. For example, truck tarps—the waterproof sheets that are used to cover loads on trucks—seat belts,



↑ Recycled car tires can even be used to make sandals!

and movie billboard posters can be turned into bags. This allows less waste to be produced, keeping the environment cleaner and healthier.



Recovering objects

REDUCE, REUSE, AND RECYCLE

Since many more people live in urban areas nowadays, the quantity and variety of waste these areas produce is increasing. As such, it's important to preserve natural resources and protect the environment by following three simple rules: reduce, reuse, and recycle. First of all, it is important to **reduce** the amount of waste produced, meaning the quantity of objects and food that ends up in the garbage each day. For example, we can drink water from the tap instead of buying it in plastic bottles, or take a fabric bag when we go shopping so

there's no need to buy plastic ones at the store. It is also important to **reuse** everything we can: from bottles that can be refilled multiple times to old clothes that can become rags for cleaning. Finally, **recycling** sorted materials means being able to use them again to produce other objects. For example, magazine or newspaper pages can be processed and the paper reused to produce notebooks. And that's not all: a sweatshirt can be made by recycling between 10 and 15 plastic bottles!

↓ An effective way of reusing objects takes place at swap parties, where people exchange clothes, books, toys, and other objects.

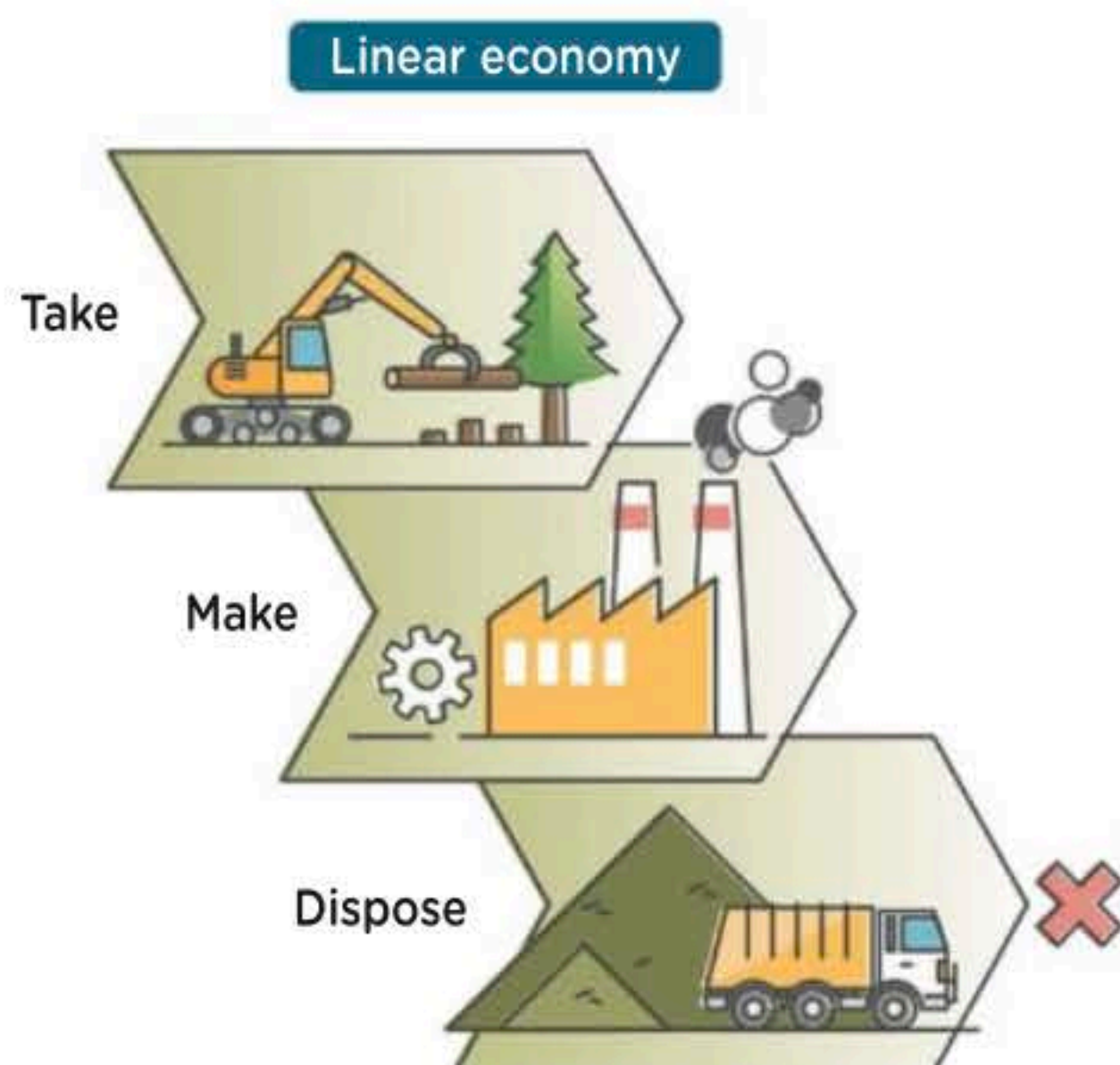


HOW TO RECOVER OBJECTS

What does recovering an object mean? It means that instead of discarding it and replacing it with a new one, we try to repair it so it can be used again. Or when objects are no longer in good enough condition to be used, they can be kept and used in different ways. For example, shoes that we've grown out of can be used as flower pots, while a can of beans can be emptied, washed, and painted to make a penholder. With a little imagination, the possibilities are endless!

WHY RECOVER?

Recovering objects allows them to be used for longer. And then, when objects can no longer be repaired, they can be sorted and recycled, that is, transformed to be used again. This is called a **circular economy** because it is as though the object stays within a loop: it is created, used, and reused, and then, after use, recovered or recycled so the process can start all over again. This allows an object



↑ At restart parties, experienced people help repair objects that are broken or don't work properly.

to be used for as long as possible. For example, certain organic waste, like fruit peels or vegetable scraps, can be used to make compost, a natural substance used to make the soil more fertile. And new fruit and vegetables can be grown on that soil. Circular economy practices can be undertaken by anyone anywhere, even at home.

↓ Unlike the linear economy, where objects are used and then thrown away, the circular economy is based on reuse or recycling.



Packaging or no packaging?

THE PROBLEM WITH PACKAGING

Packaging is the way a product is packed and preserved in order to reach the consumer. It is important because it ensures that the product doesn't get damaged and dirty. Packaging can consist of various materials, with paper and plastic the most widely used. Once the package has been opened though, the packaging becomes waste to dispose of.

Over time, the amount of packaging used **has increased**, causing tons of garbage to be produced every year, but luckily, the number of people who separate waste is also growing, so the recycling of paper and plastic is growing as well! Even though we're still far from balancing out the waste we produce, the rates for recycling these materials are constantly increasing. This is also due to the growing sensitivity of producers, who are creating lightweight packaging that can be easily recycled or reused.

THE SOLUTION ON TAP

Decades ago, products in stores were sold **loose**, meaning they weren't packaged. But since the arrival of supermarkets, loose products have been replaced by packaged ones. And so packaging waste has increased. Luckily, loose products are now available again and sometimes they're described as **on tap**.

At the store, you buy the amount of what you want—rice, for example—and put it in a container to take home. Once you've finished the rice, you go back to buy more using the same container or, if you don't want any more, you leave the container at the store for other shoppers to use. It's an excellent way to reduce waste, taking only the amount you need and using the same container several times.

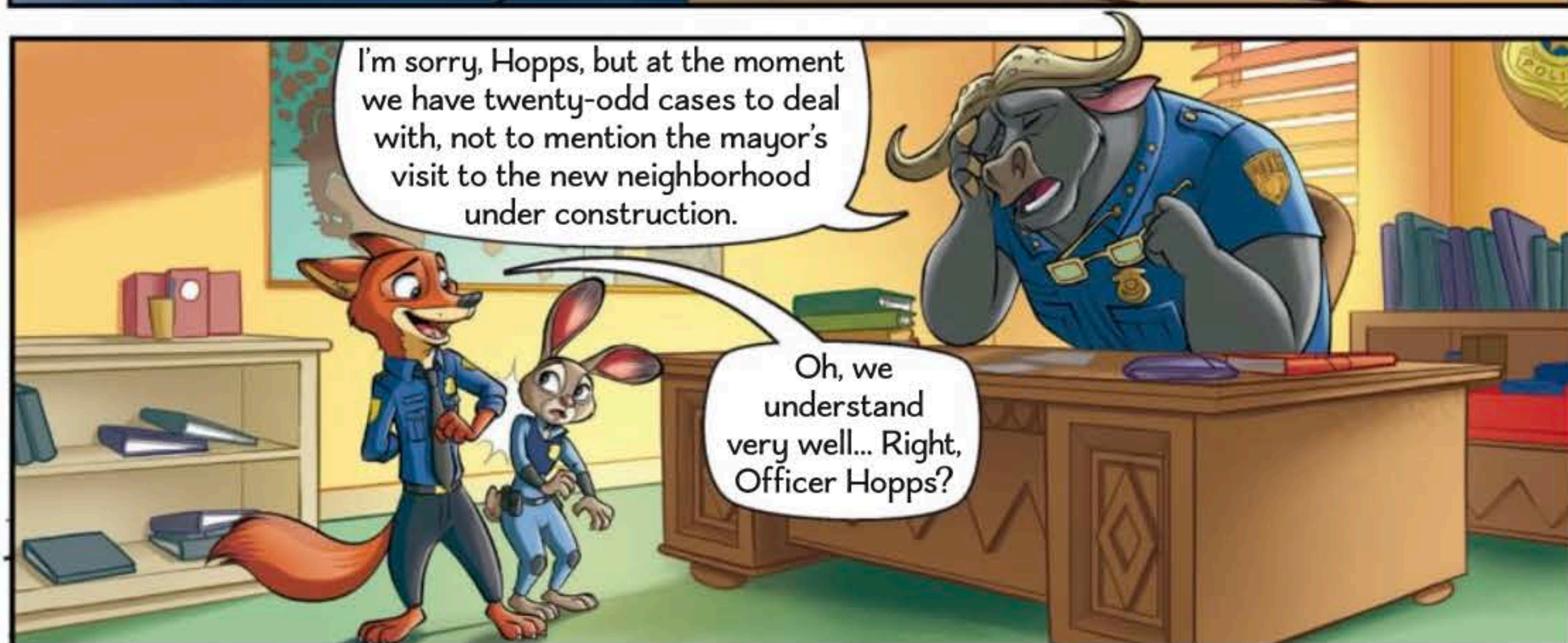


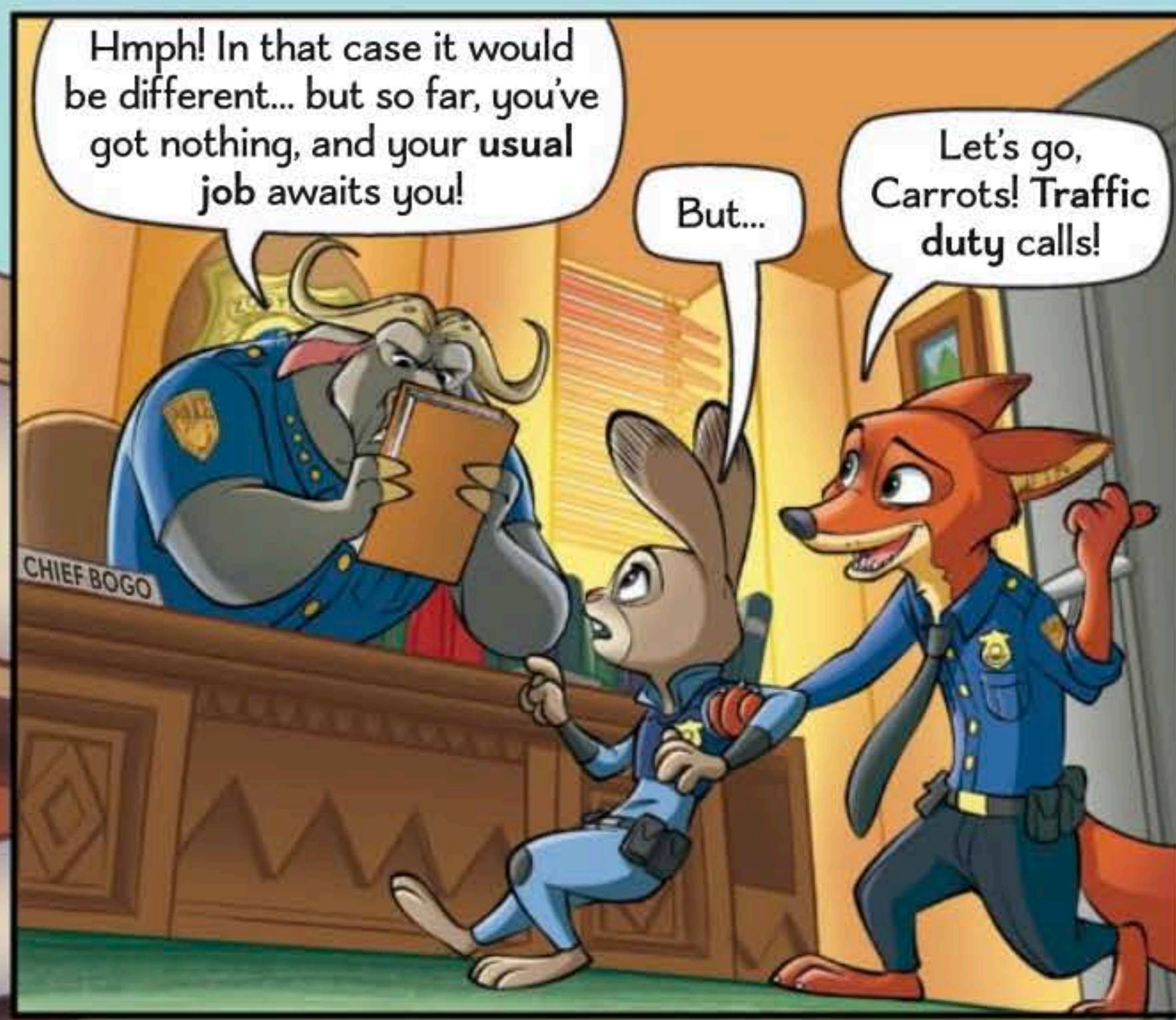
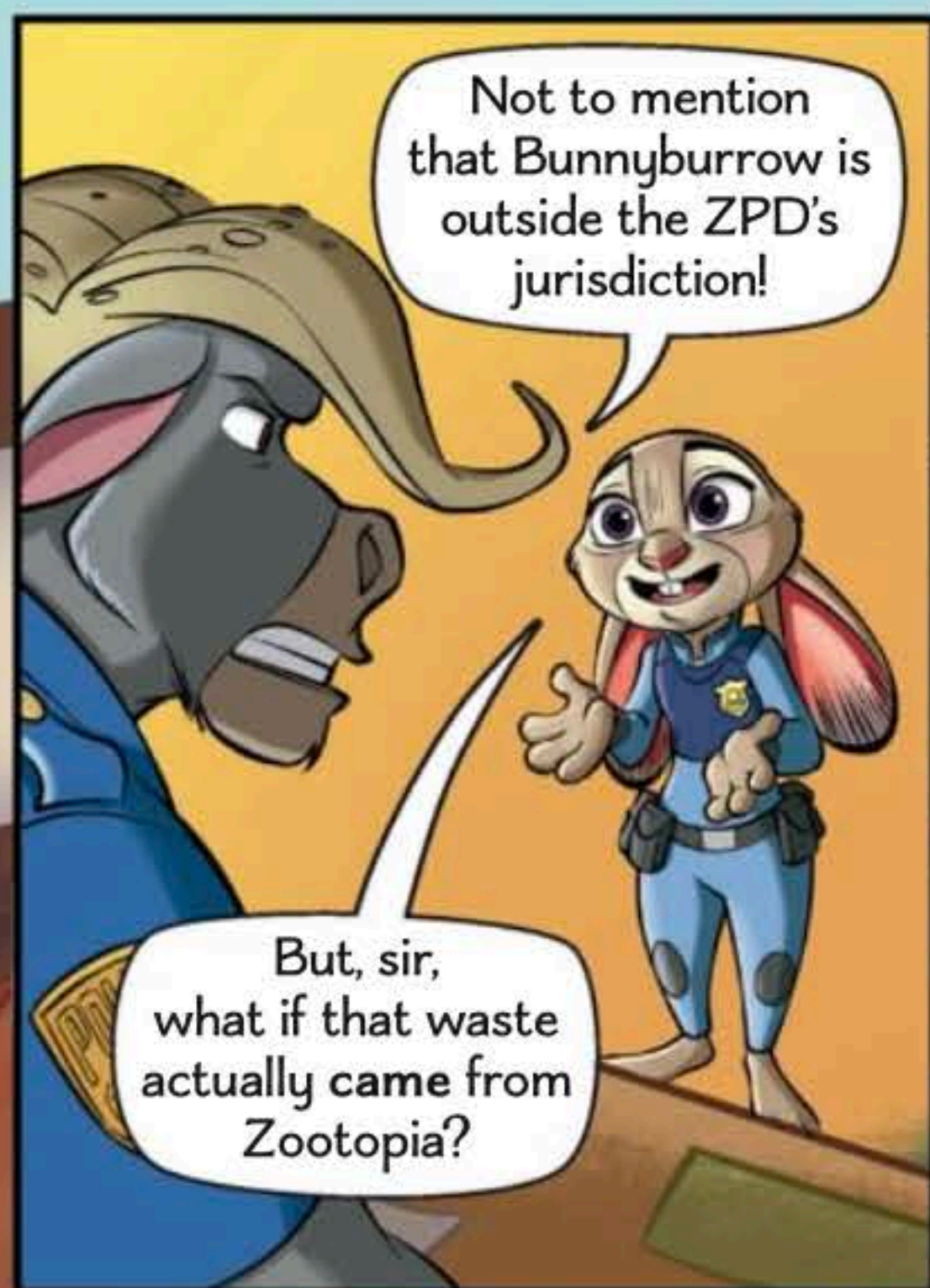
Loose products are often grown or prepared near the stores that sell them. In this way, they don't need to be transported for long distances via air, road, or rail, making them more environmentally friendly.

SUSPICIONS



Illegal dumping
of toxic waste by
unknown persons,
you say?







Later that day...










*Green: this word is often used to mean "environmentally friendly".





Like bamboo and straw, **raw earth**—that is, clay left to dry in the sun—also has very little impact on the environment. It's an abundant resource, it isn't processed with chemicals, it doesn't produce polluting waste...

And finally, it can always be returned to nature one day. What's more ecological than that?

I didn't take you for a **green building** expert.

What can I tell you? Living under a bridge makes you kind of **environmentally aware**!

Hmm. At least there's still one **normal building**: that one there!

Oh, it only looks normal, dear!



The walls of the house are lined with an organic and economical material that **doesn't pollute: wool!**

It's an excellent natural insulator, both against the cold and against the heat. And it's all locally sourced, because we produce it!

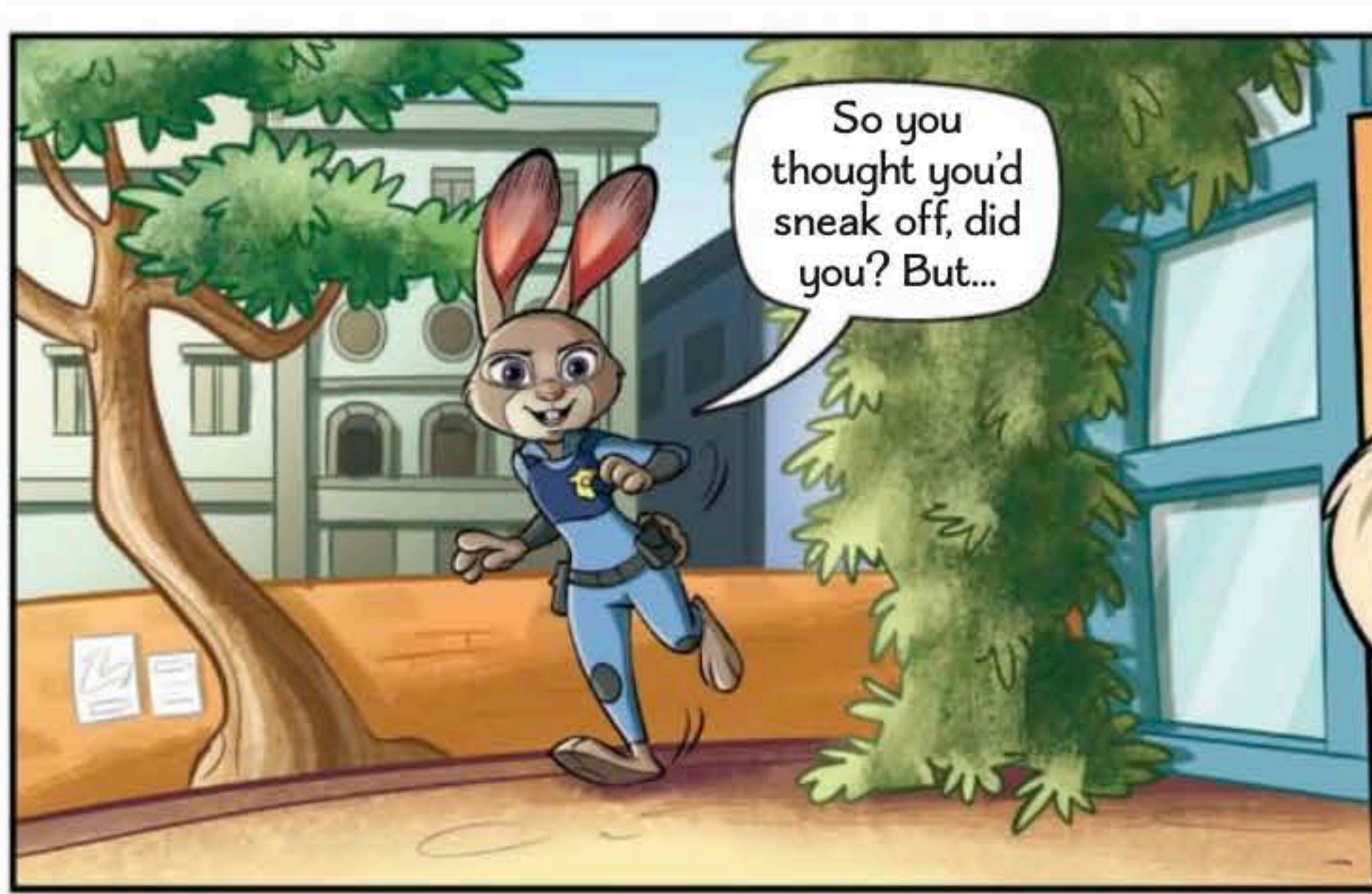


Looks like the mayor is trying to change the city for the better, Nick!

NICK?!



What's up with him today?



So you thought you'd sneak off, did you? But...



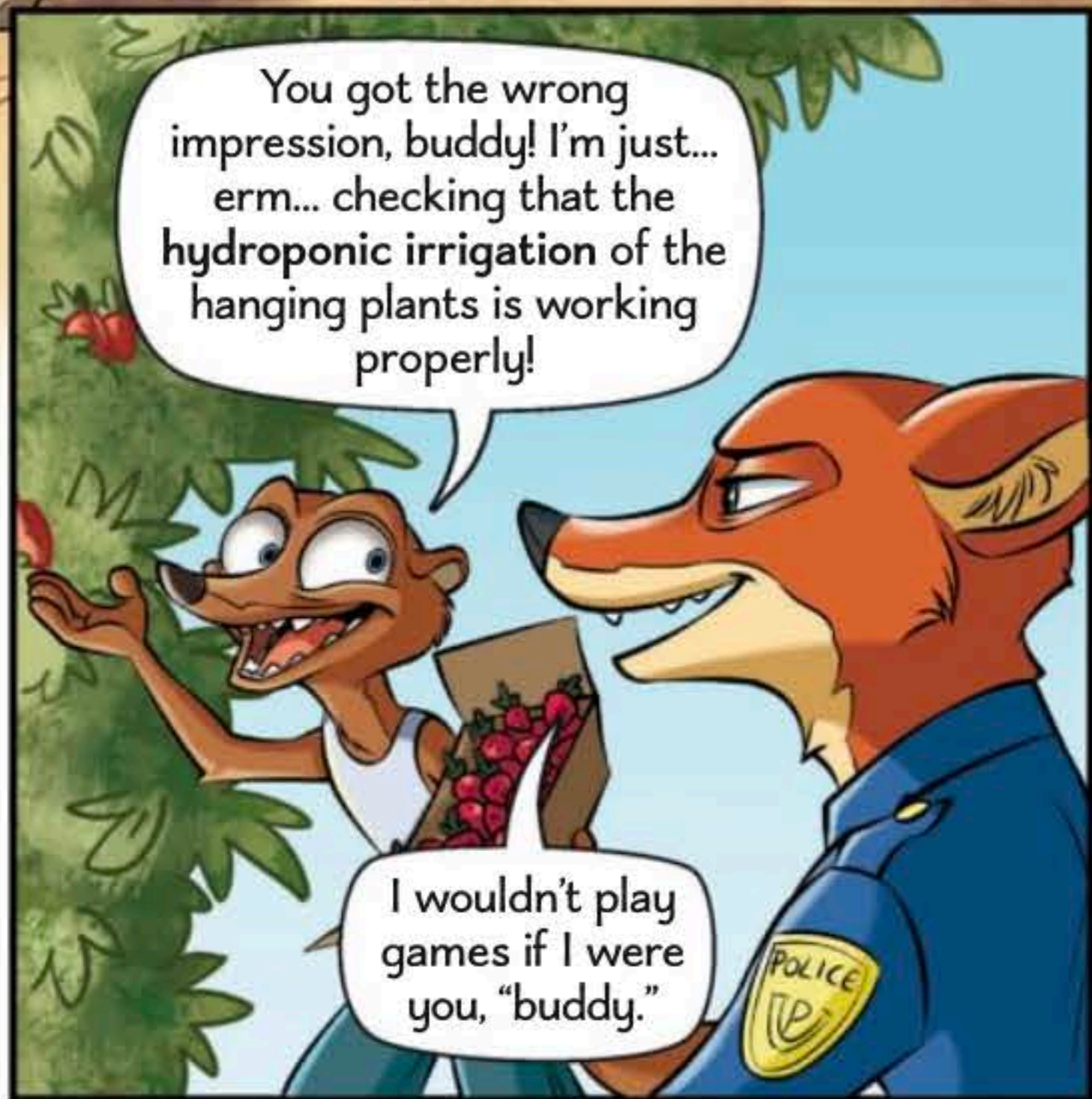
≡Gulp!≡



It's that lowlife Weaselton. And for a change, he's stealing strawberries from this farmscraper's cultivated wall!



And Nick seems to be in cahoots with him! Then he really has gone back to hustling!



You got the wrong impression, buddy! I'm just... erm... checking that the hydroponic irrigation of the hanging plants is working properly!

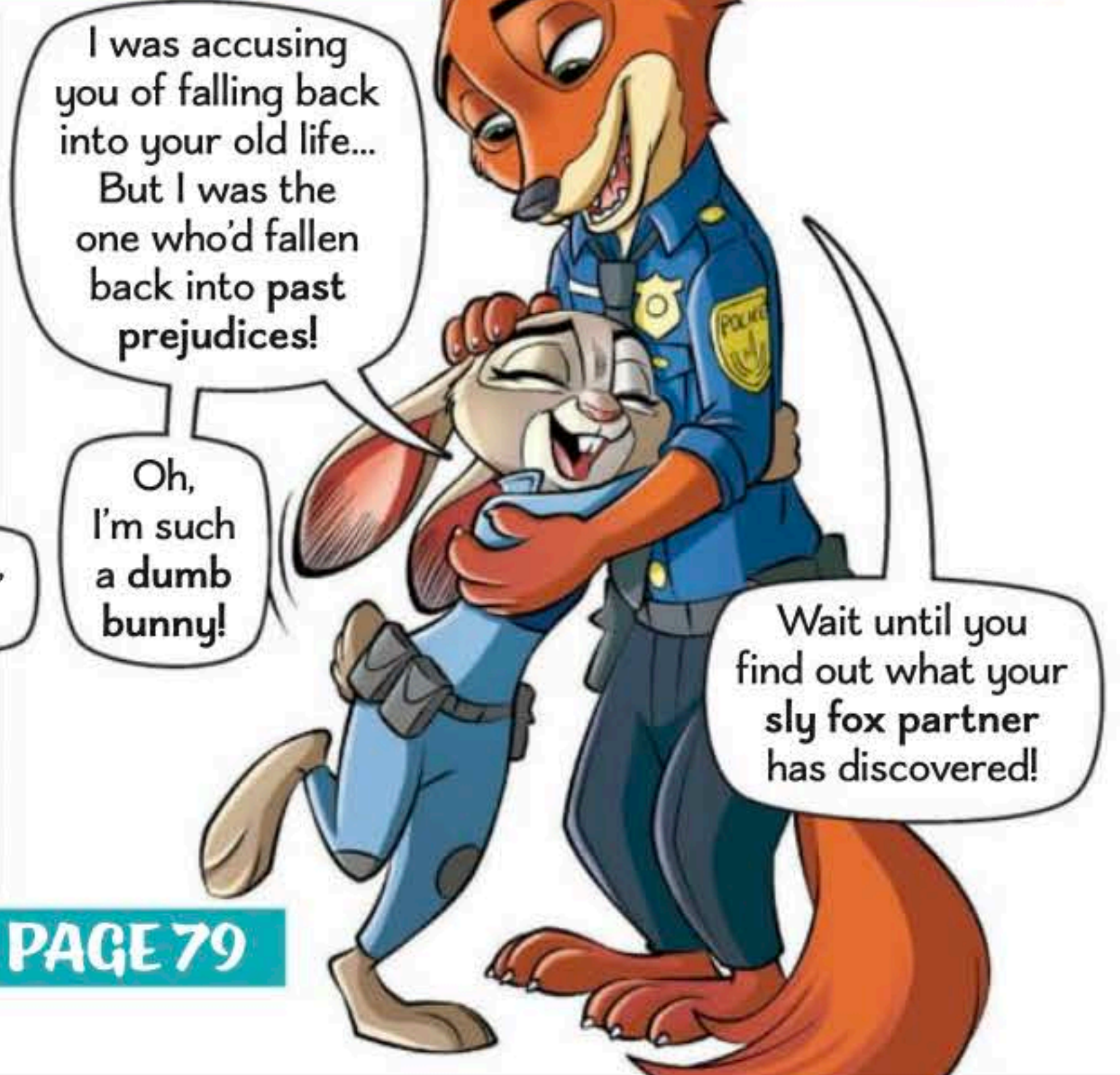
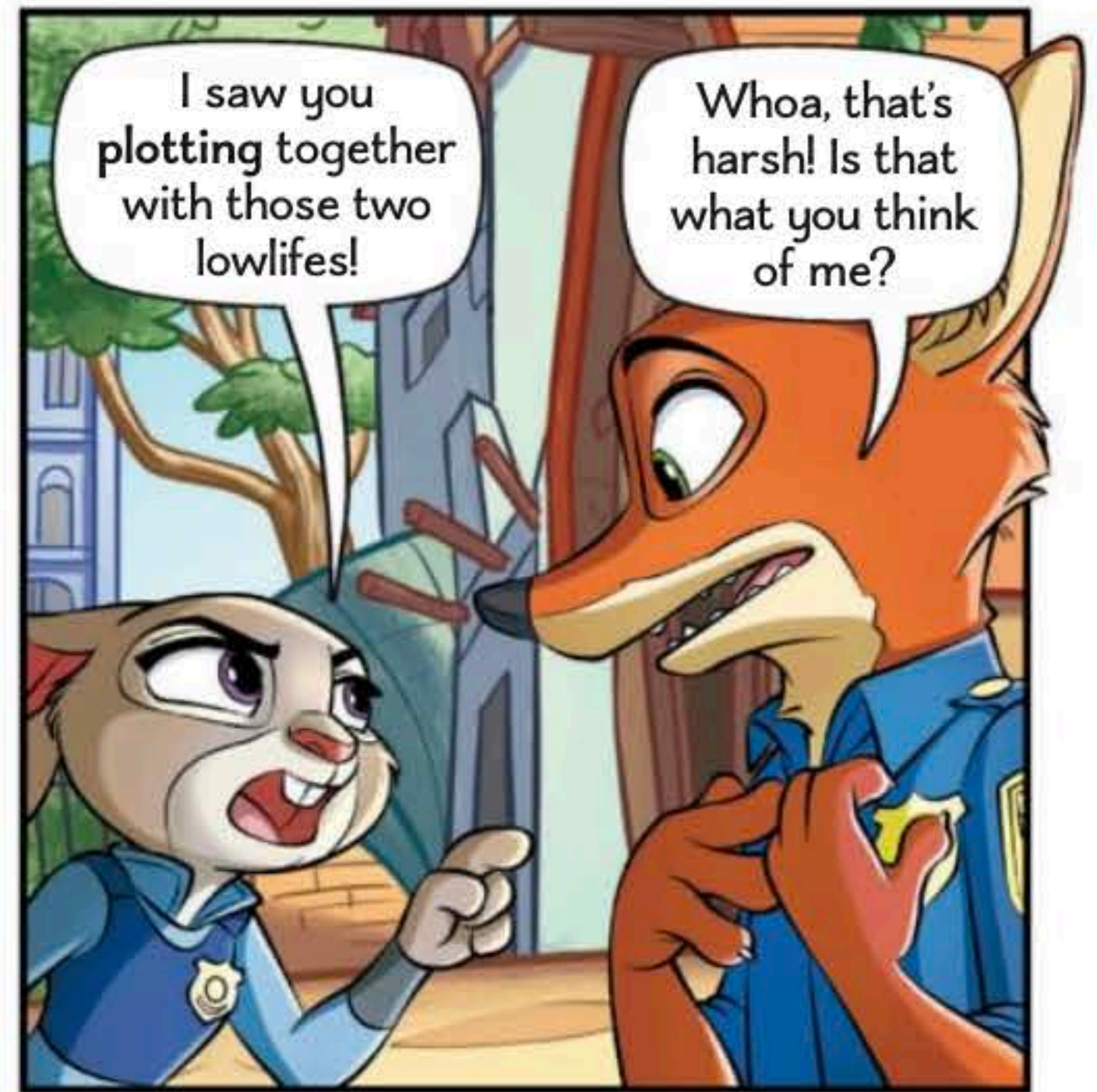
I wouldn't play games if I were you, "buddy."



Remember what happened last time?

≠Gulp!≠
OKAY!

You better tell me what I want to know... and quick.



CONTINUES ON PAGE 79



SUSTAINABLE ARCHITECTURE

- A new way of designing
- Passive strategies
- Local and natural
- The importance of soil

A new way of designing



WHAT IS SUSTAINABLE ARCHITECTURE?

Most of the time when constructing a building, such as a house or a shopping mall, resources are used up and pollution is released into the environment. In order to reduce this negative impact, the practice of **sustainable architecture** has been developed. Sustainable architecture is about designing buildings that respect the planet and its inhabitants. One of the most important aspects is to allow people to **live well** in their



Building a house with materials widely available on site is an example of sustainable construction.

homes, with clean air inside and a balanced temperature maintained. The building is also constructed in **harmony with the landscape**, using local materials as much as possible, reducing transportation, use of energy, and consequently pollution, as well as without harming animals and plants in the area. Finally, only **materials that are easy recyclable** are used so that if the building is demolished they can be sustainably disposed of or reused.

Passive strategies

WHERE AND HOW TO BUILD

Architecture can be designed using **passive strategies**, practices that make the most of natural local conditions to maintain a comfortable temperature inside a building, thus reducing the need for electricity to power a heating or cooling system. In this way, they help reduce pollution and so are a good example of sustainable architecture.

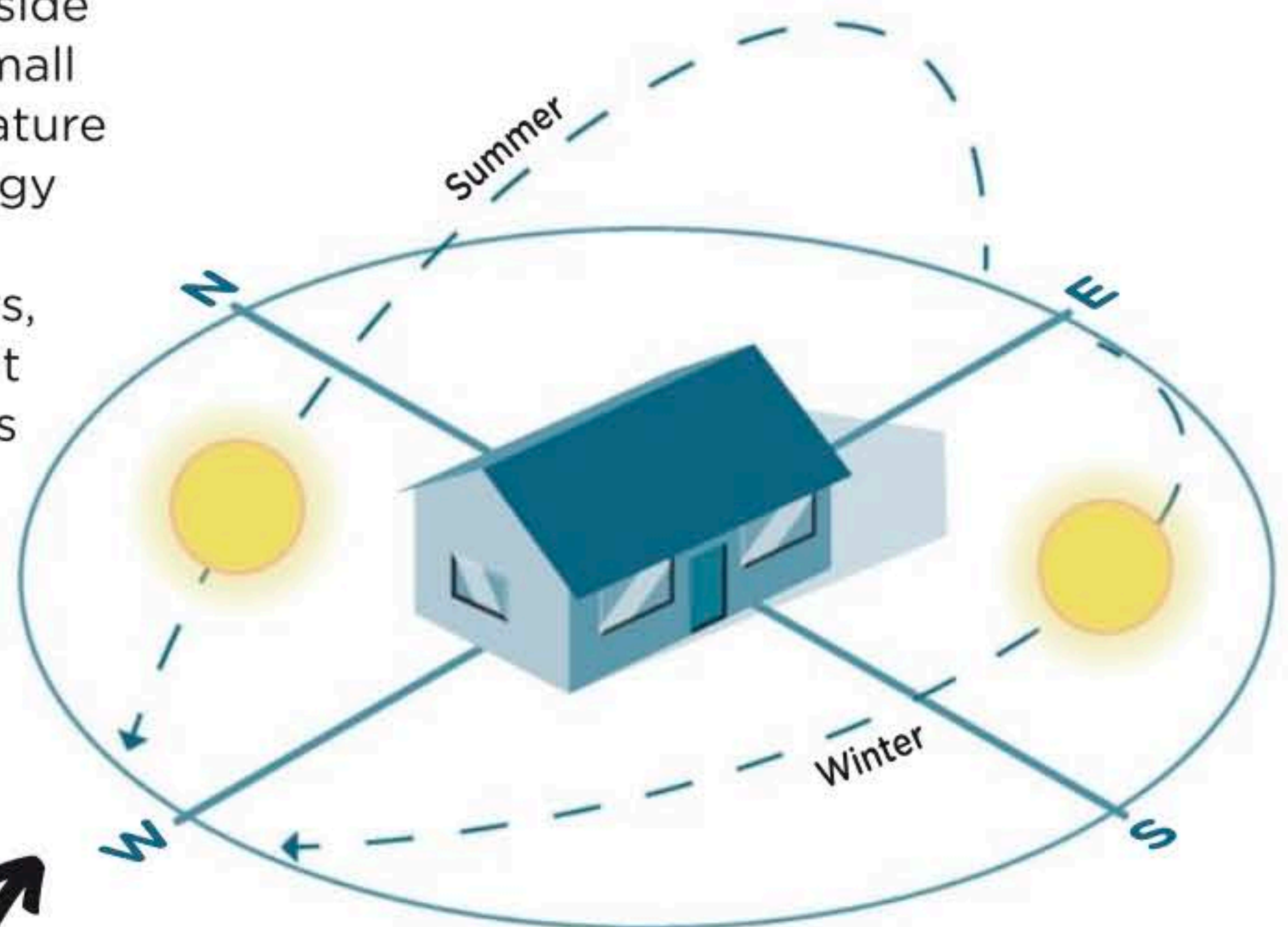
Passive design strategies are planned taking into account the specific location and its climate. Attention must be paid to the **orientation of the building**, meaning its position in relation to the sun. In hot places, for example, it's best to construct buildings with few rooms on the south side, which is the sunniest part, while it is better to do the opposite in temperate climates. In any case, it is advisable to have as few, and as small, windows as possible, because it's through windows that heat passes most readily from the outside to the inside. Thus, having few, small windows allows the inner temperature to be kept cool and reduces energy consumption. Indeed, cooling machines, such as air conditioners, are used less when the house isn't as hot, resulting in energy savings and less environmental pollution.

But that's not all. The **shape of buildings** can also help. Basically, the fewer surfaces

In order to take full advantage of the sun's heat in temperate climates, houses should be oriented east-west.



and corners they have, the less buildings are exposed to wind and air penetration. What's more, compact shapes prevent heat loss, so the best solutions are dome-shaped and cube-shaped houses.



Local and natural

VERNACULAR ARCHITECTURE

Vernacular architecture is a type of traditional construction that uses locally available and natural materials, such as **earth, stone, wood, bamboo, or straw**. It is closely influenced by the specific local conditions, including climate, vegetation, landscape, and culture, and is increasingly used today in contemporary architecture. Scientists are studying how to make the most of it, as vernacular architecture buildings are very sustainable. For instance, the materials are available in the local area, so they don't need to be transported for long journeys, and are easily recyclable. What's more, the buildings don't need to use energy for heating or cooling, as the temperature inside them is regulated by the natural materials' insulating properties. In the Arctic, for example,

the Inuit build their traditional dome-shaped hunting shelters, called igloos, using snow, and a fire inside the igloo is sufficient to keep its occupants warm.



↑ Wind towers are traditional architectural elements typical of Western Asia and North Africa. They are made of clay and used to create ventilation and passive cooling in buildings.

GRASS ROOFS

Energy consumption can also be reduced, for instance, by using natural materials instead of artificial ones like concrete to cover the roofs and walls of buildings. Roofs can be covered with earth and plants, for example, because both provide better insulation than concrete from heat and cold. What's more, they also absorb rain, noise, and pollution produced by home heating systems or by traffic. A popular solution is to grow a **roof garden**, which can be used by the residents as a precious open-air relaxing area.



The importance of soil

EVEN SOIL IS CONSUMED!

Even when a building is made sustainably, some **soil** is consumed. Soil is the **loose natural material** covering Earth's surface before it is touched by humans, such as the ground of the grasslands, the earth of the forest floor, and the sand along the coasts. It is very important because it provides **resources and raw materials**: the nutrients it contains are essential for growing plants for food, trees for timber, and pastures for livestock. Plus it also **regulates water**. Indeed, when it rains a lot, the soil absorbs and filters much of the water, preventing natural disasters like floods. What's more, the soil is fundamental for Earth's health

because it's the environment with the highest rate of **biodiversity**—the variety of species and habitats—in the world. Just a teaspoon of soil contains a large variety of organisms, such as insects, fungi, and bacteria, which all live close together.

Every time a building or a road is constructed, the soil is **covered with concrete** or other materials and is no longer able to absorb the rain. As a result, it no longer produces resources and **loses its natural functions**. This is why it is better to renovate old buildings instead of constructing new ones, thus covering more soil with concrete.

Even after destroying old buildings and reclaiming the land they used to cover, it takes the soil a long time to return to its natural, origin state.



WILD CHASE!

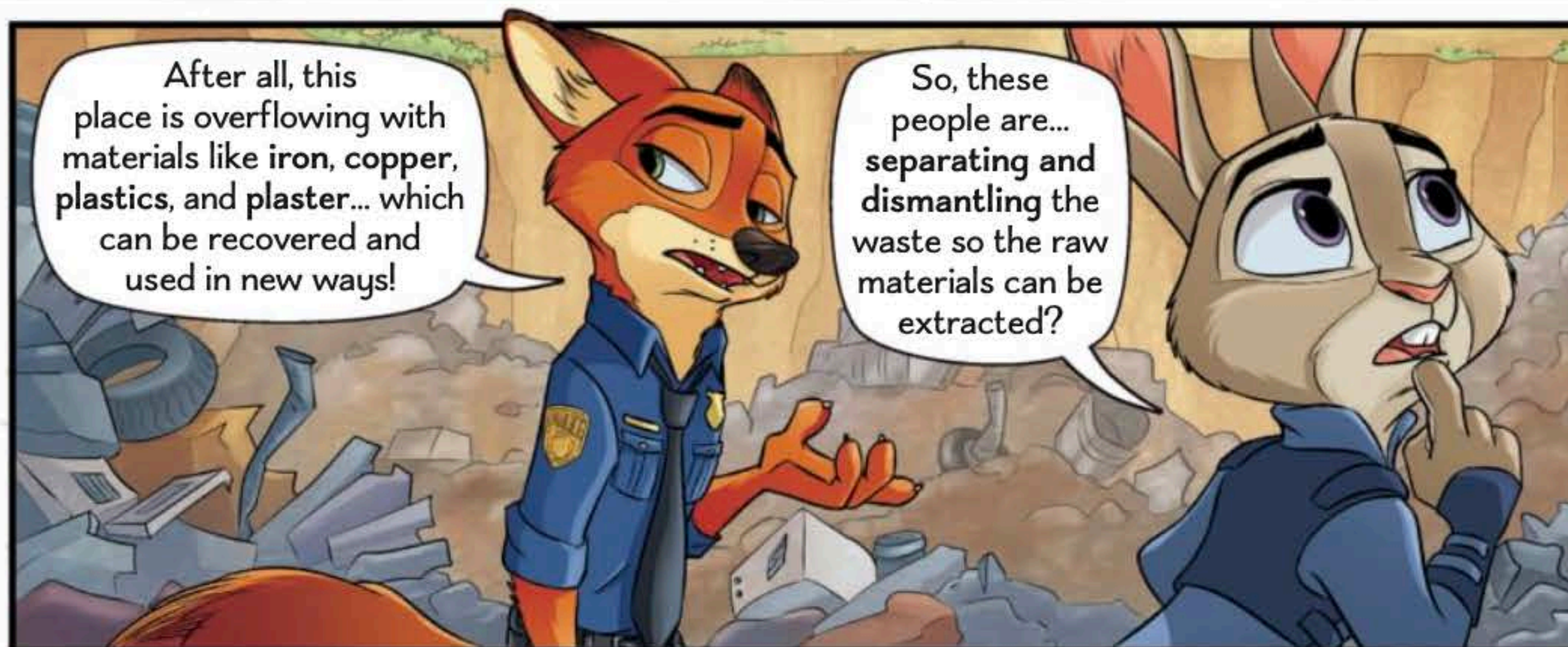
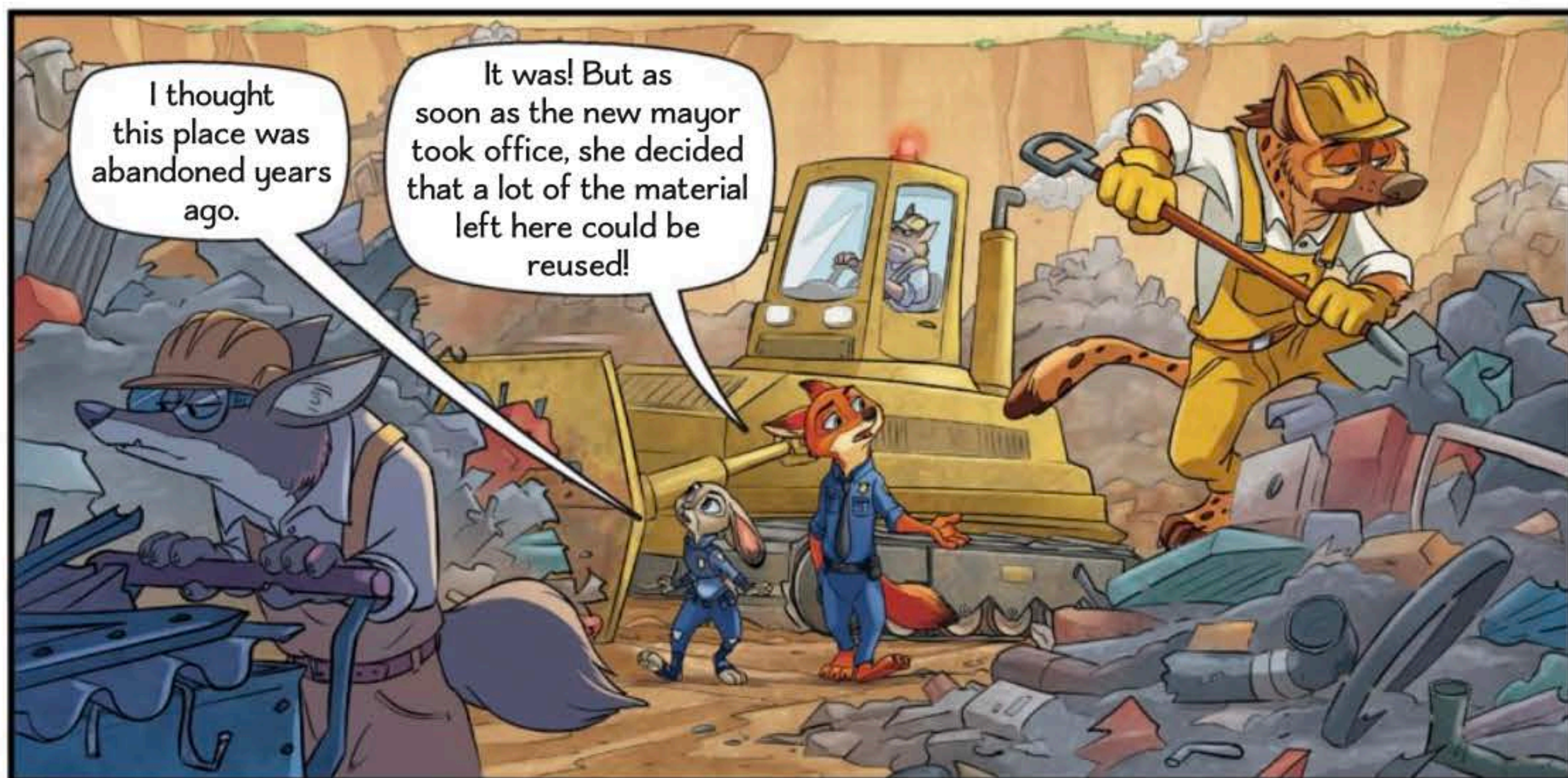


Are you seriously telling me that Weaselton told you to try here?

More mumbled than told, but yes. Though pretty reluctantly, Duke's exact words were...

... try the old city landfill!





In **URBAN MINING**, the raw materials contained in the scrap are already refined and easier to reuse!

From **discarded batteries** you can get: lithium, nickel, cobalt.



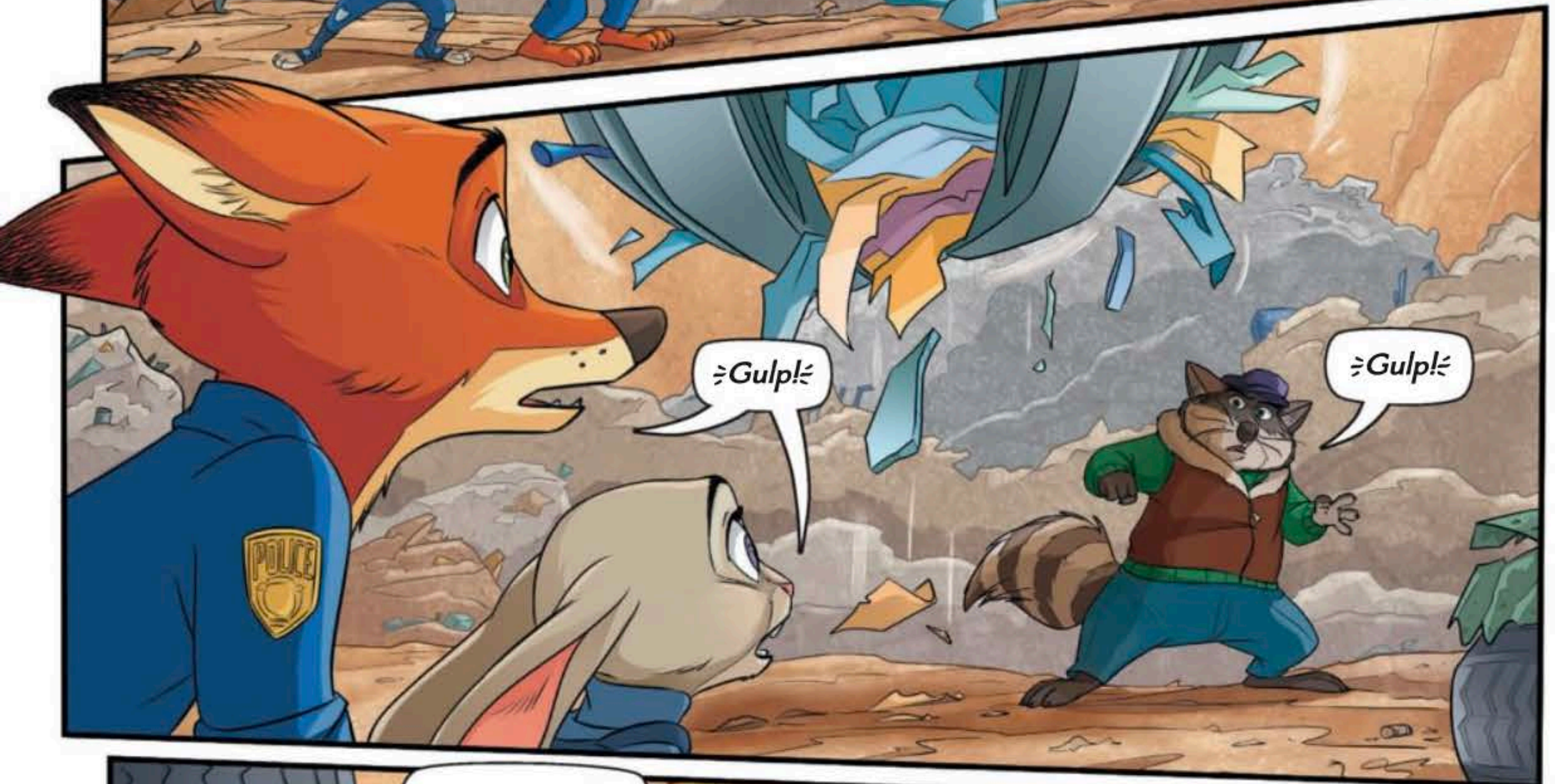
From **old computer components**: copper, iron, tin, zinc, aluminum, lead (plus silver, gold and platinum!)



Old concrete: this can be ground into powder and used again.









Hang on, Rings! I'll stop them!

BARRUMMP

ROAAAR

What...?

It's the truck!



No way!
They're not getting away with it this time!

They're really starting to ruffle my fur!



Hahaha! We showed those two cops!

I'd hold off on your victory dance, Dottie.

Huuuuh?!



These guys are hard-core, Dottie! They don't quit!

Yahooooo! Keep it up! We're catching up to them, Nick!

This is definitely the most **unusual** vehicle I've ever used!



We'll see about that!

SKWEEEEEE



Turn left, Nick!

Oops! I don't think I can!

BUMP



Don't worry about me, Carrots! Get those

tWOOOOOOOOOO!



Ha, ha! One down!

But that bunny just won't quit!







They've
trapped us with a
scrap magnet!

Haw haw! I got
the two meddlers,
Dottie!

Well done,
Stripe! Now get
rid of them!



Uh-oh!

CONTINUES ON PAGE 93

MATERIALS AND TECHNOLOGY

- Alternative materials
- The environmental cost of technology
- The technological life
- Mines in cities



Alternative materials

MATERIALS OF THE PAST AND PRESENT

For thousands of years, people have used **natural materials**, like wood, and natural fibers, such as cotton. Then new discoveries in the field of materials allowed the spread of **artificial** ones, which are created by humans using natural raw resources. One of the most important is **concrete**, made by finely grinding two types of rock, limestone and clay, and adding water. After it dries, it sets as hard as stone! Another very widely used artificial material is **plastic**, created around 1970 from **petroleum**, a dark, dense liquid extracted from the ground. A few decades later, **silicon**, a natural

material found in rocks, became one of the most important materials of our time, as a key component of computers and all electronic devices, including TVs and smartphones.



Early people used the resources offered by nature, such as rocks, wood, and animal furs.

© Shutterstock



The environmental cost of technology

SMARTPHONE MATERIALS

Till the end of the 20th century, **telephone calls** were made using a device with a cable connected to a plug in the wall. Then **cell phones** were invented, making it possible to place calls wirelessly for the first time! Cell phones gradually became very widespread, and the number of things they could do, that is, their functions, steadily increased. More recently, the **smartphone**, an upgraded model of the cell phone, was invented. This is a multifunction cell phone used to make phone calls, take photographs, and do many other things. However, smartphones don't differ from the landline phone just in their functions but also in **the number of raw materials** needed to make them. Indeed, while the landline required about 12, a smartphone uses around 50!



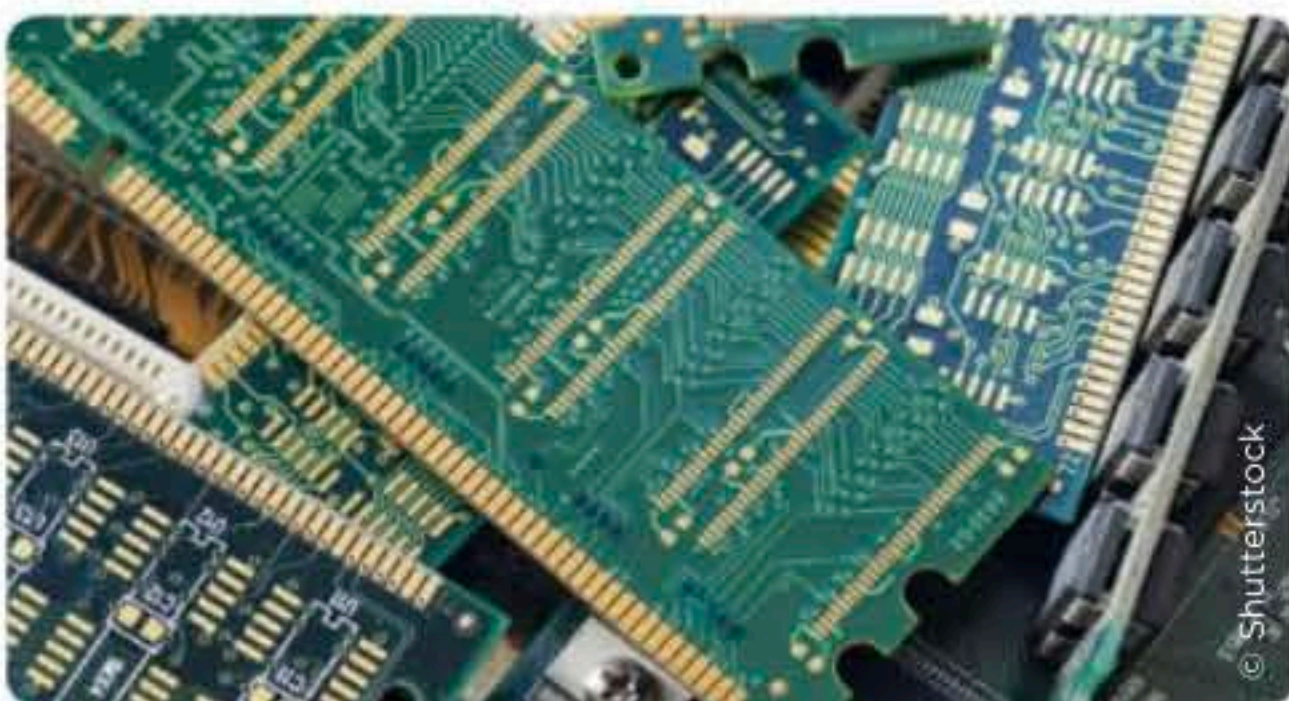
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Some of the many raw materials contained in smartphones are very polluting and toxic. For example, cadmium, which isn't just bad for the environment but can also potentially hurt humans by weakening their bones.

ENVIRONMENTAL WEIGHT

A smartphone weighs about 200 grams. However, in addition to its physical weight, it also has an



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Recycling electronic devices allows the precious components they're made of, like gold and silver, to be recovered.

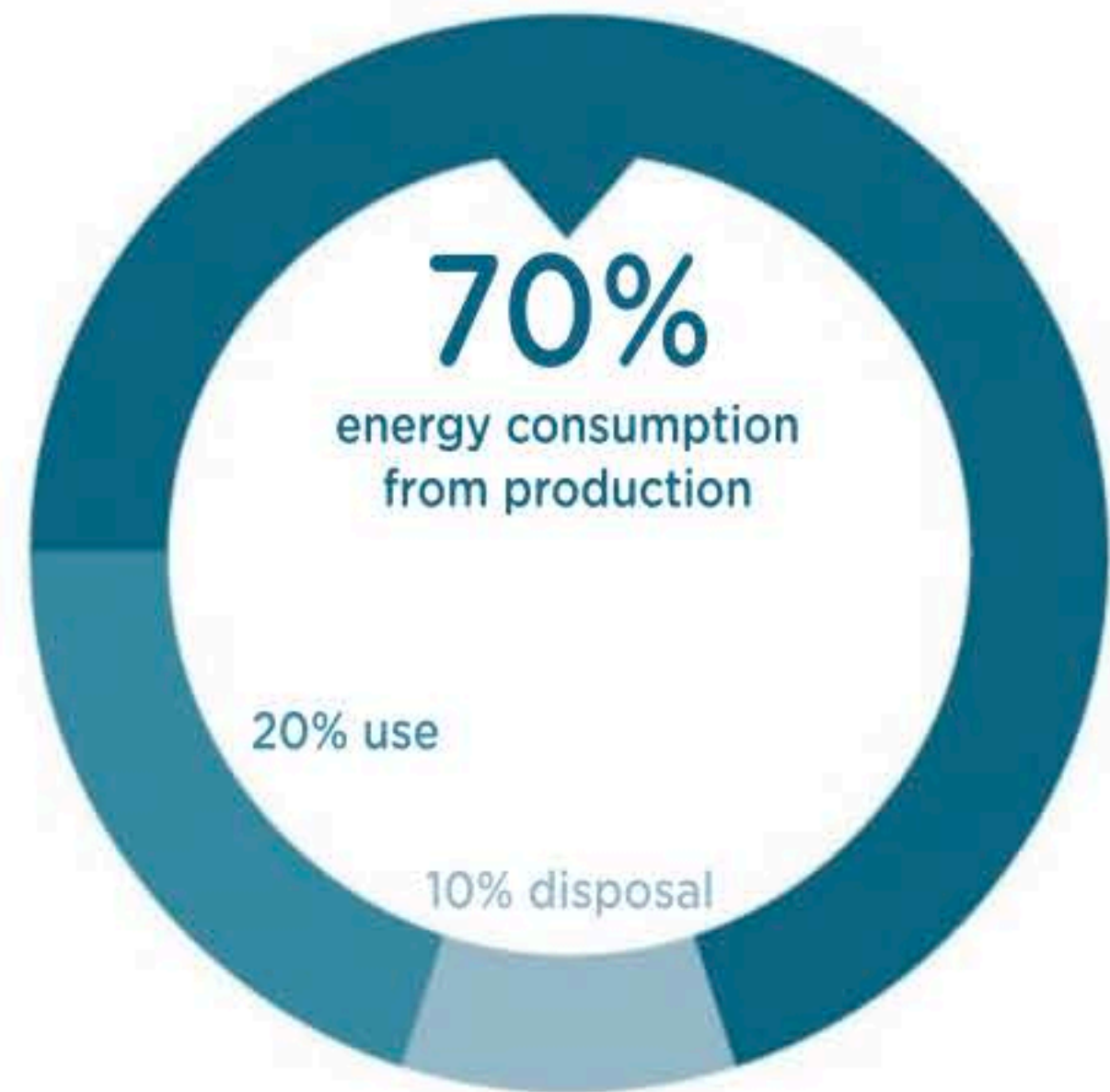
environmental weight, meaning the **weight of the raw materials** used to produce it, which is over 80 kilos! A finished smartphone is so much lighter because all the stones and gravel mined in order to extract the raw materials, chemicals, and water used for its manufacturing, are discarded. Then, the **discarded materials become waste** that must be disposed of correctly, otherwise it can cause severe pollution. And because there are so many objects produced using multiple materials, their environmental weight is huge. One way of reducing it is to limit constant production of these objects by using them for **as long as possible** before replacing them..

The technological life

HOW MUCH ENERGY DOES IT COST?

Today, almost everyone uses technological devices such as computers, tablets, and smartphones. Each of these objects has a **life cycle** that starts when the materials needed to make it are gathered and put together.. It continues while the object is used and ends when it is thrown away and the materials that compose it are disposed of. Each of these steps uses some energy to be completed, and **most of this energy is consumed before** the technological device (a tablet, for example) arrives at the store where it will be sold. That is because over 70% of the total energy used in the average life cycle of a device is used

in its production! And only 20% is consumed by the person who buys the device.



Only 10% of the total energy involved in the life of a technological device is used in its disposal, while the majority is used to produce and assemble it.

BUILT TO FAIL

Today, most electronic devices are **built to fail**. This is called **planned obsolescence**, meaning that devices like televisions and laptops are manufactured in such a way that they stop working within a certain period of time so that people are forced to buy new ones to replace them. This is sometimes achieved by using **low-quality materials** or by ensuring that repairs for breakages are too complicated and expensive. As a result, the average service life of mobile phones is less than two years, even if they could potentially function for much longer. Something similar often happens in the fashion industry too: clothes are made with cheap fabric to keep the prices low,

but this also means that they wear out quickly and need to be replaced within a short time.



Mines in cities



URBAN MINING

When electronic devices are thrown away, they end up at recycling centers. As in the case of many other objects, their reusable components are salvaged there. This process is called **urban mining**. Basically, it works a bit like a mine dug into a mountain or underground, just that in the case of urban mining, the **digging takes place in the city among the refuse**.

All sorts of things can be salvaged through urban mining. For example, materials for new buildings can be recovered from the remains of a

↑ Urban mining doesn't just take place in recycling centers, but also in unsorted-waste landfill sites, which can be another important source to recover precious raw materials.

demolished house, and as we have seen **precious raw materials**, like cobalt, gold, and silver, can be found in many electronic devices, like smartphones. These devices can be taken apart to recover the internal components and the different raw materials they're made of, like silicon, copper and iron. These raw materials are **96% recyclable**, meaning they can be treated so that they can be reused to make other electronic devices. Consequently, there is less need to search for new raw materials, with the result that **energy is saved** and the environment polluted less!

WHAT LIES BENEATH

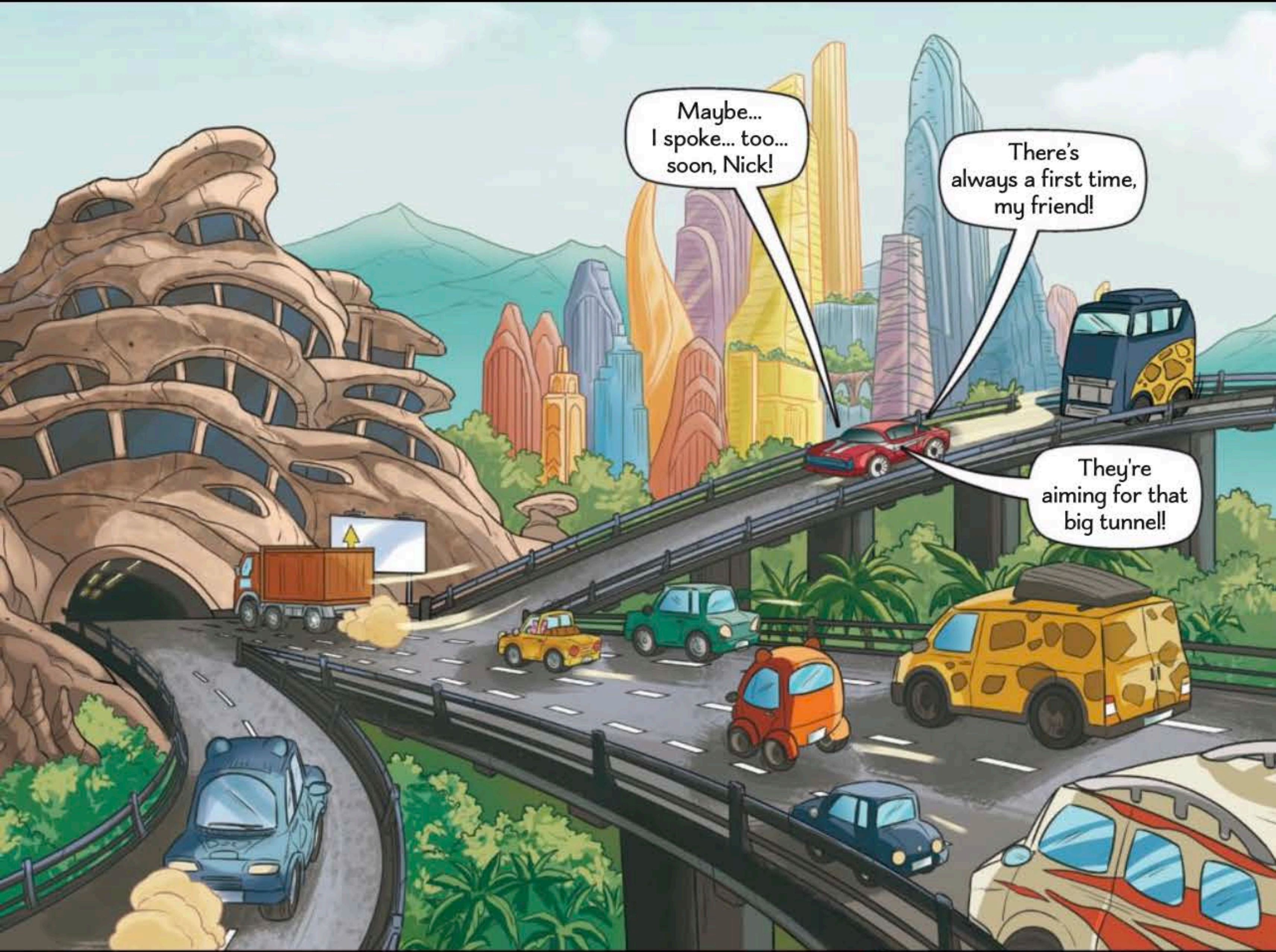
KA-CHUNK

Haw haw haw!
Happy landings,
cops!

Let's get
out of here,
Judy!







Maybe...
I spoke... too...
soon, Nick!

There's
always a first time,
my friend!

They're
aiming for that
big tunnel!



By the look of things,
Carrots, we're going to have
to continue our investigation
in the **underworld**!

Among the
criminals, you
mean?

No, I mean
literally **under**
the ground!



We're in
the Nocturnal
District!

Zootopia's
underground
district? I've never
been here before!

welcome to

NOCTURNAL
DISTRICT



For the most part
its residents are nice people,
but this place is also home to
some shady characters!



Whatever it is, I think it's a fascinating place!

In its own way, it sure is!



An underground city has some of advantages.

Such as?

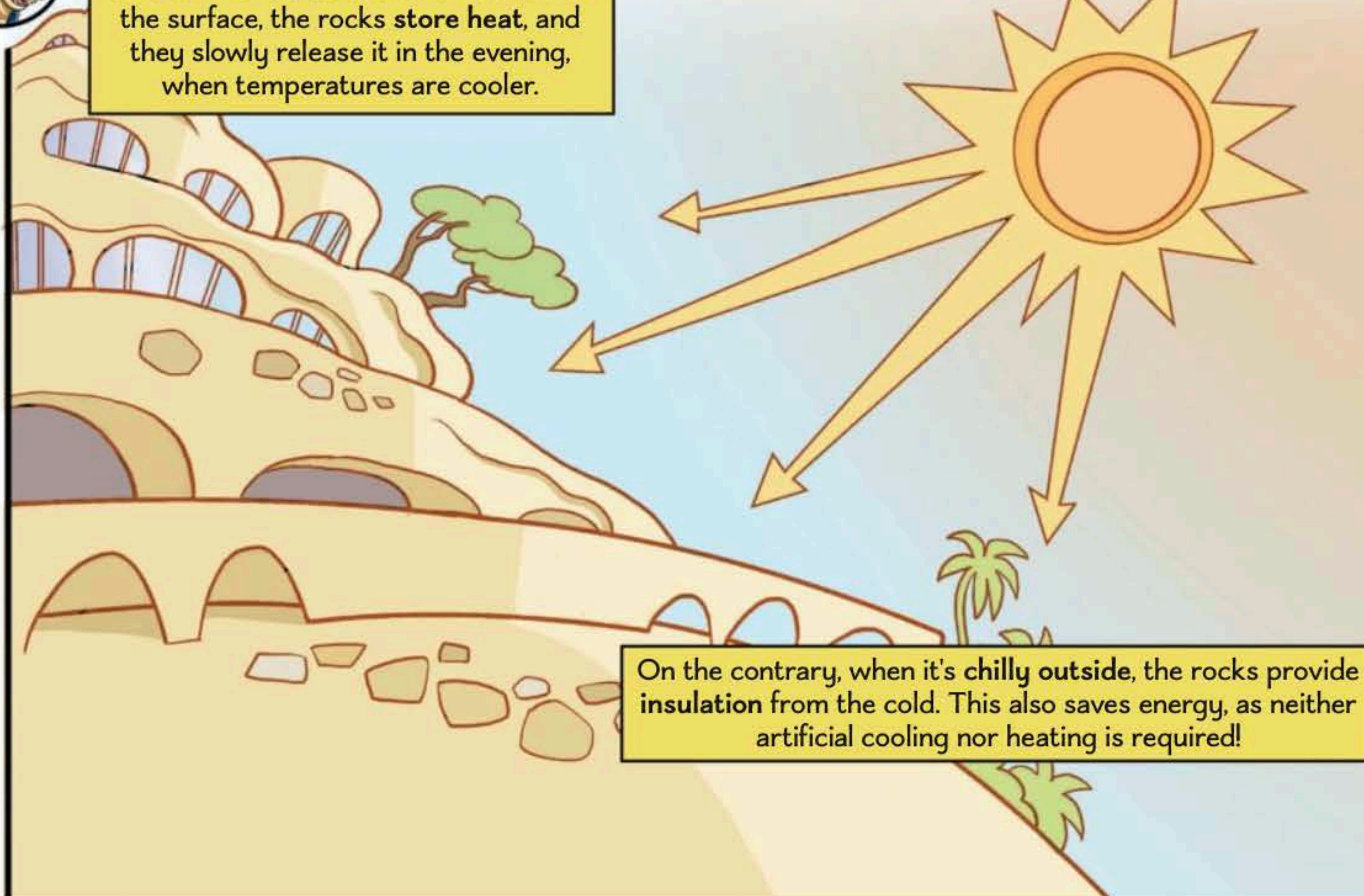


Well, for a start, living in rock cavities offers good protection from excessive changes in external temperatures!

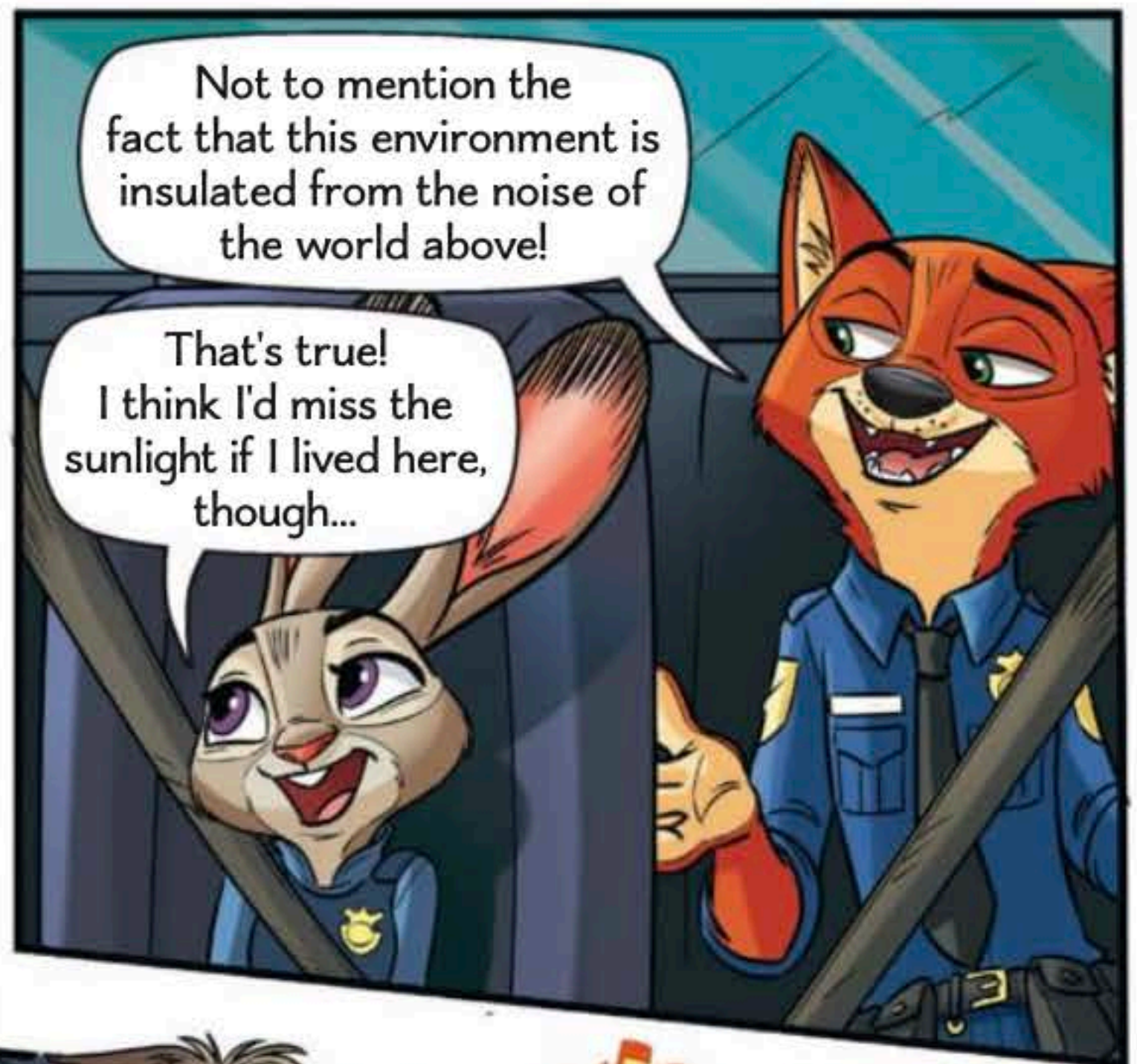
How so?



In fact, the temperature down here is stable. This is because when it's hot on the surface, the rocks store heat, and they slowly release it in the evening, when temperatures are cooler.



On the contrary, when it's chilly outside, the rocks provide insulation from the cold. This also saves energy, as neither artificial cooling nor heating is required!





That's the same truck we were following!

... we... were... following!

You're a real champ, Flash! See ya, buddy!



This time we have them in the palm of our paw!

Not these guys again!

I'll call for backup!



We have a lot of questions for you!

And you'd better answer right here and now!

Suuure!

Haw!



Lemme guess: Fluffytail here is gonna be the good cop, and the fox will be the bad one?

Heh, you wish.

You got it backwards! I'm the cop you don't want to upset here, and you better start telling me what we want to know!

Starting with: who gave you permission to dump toxic waste in the countryside?



So what's going on here?

Officers Van Veldt and Packimpah, these three villains are under arrest for illicit activities and resisting arrest by a police officer!



There must be some mistake, officers! We're honest employees with a regular license to transport and dispose of construction debris, on behalf of the Skunkington Disposal Company!

Hmm! Everything does seem to be in order.



It isn't! Why was their dump truck empty at the landfill, in that case?

Well, duh! That's what a dump truck does, honey! We dumped everything in it already!

You sure did... into Bunnyburrow's river, to be precise!

Errm, Carrots... ?





CONTINUES ON PAGE 107

LIVING IN THE FUTURE

- A new kind of urban planning
- How and where to build
- The 15-Minute City
- Repopulating the countryside

A new kind of urban planning

HOW CITIES CHANGE

Urban planning is the process of designing **cities** and places where people live. For decades, urban planners have made cities larger and larger as more and more people have come to live in them. However, by **organizing the space better**, it's possible to house more people without increasing land use. Indeed, cities and neighborhoods can be

designed to make the most of the areas they occupy by renovating and **reusing abandoned buildings**; by planning an efficient use of existing spaces creating the optimal balance between people occupancy and energy used to maintain them; or by constructing **smaller new homes**.

At the beginning of the 19th century, only 5 out of every 100 people lived in a city, while today the figure is 55 out of every 100, and it's increasing every year.



How and where to build

SMALLER HOUSES

Space can be reclaimed by building houses or common areas in existing **urban gaps** in cities, such as underused spaces, courtyards between buildings, and flat garage roofs. These sites are too small to build large buildings, yet big enough for small houses. For example, thirty-seven square meters can be enough to provide the necessary space, air, and light for two people. These are called **tiny houses** and are an example of **sustainable architecture** that allows abandoned urban spaces



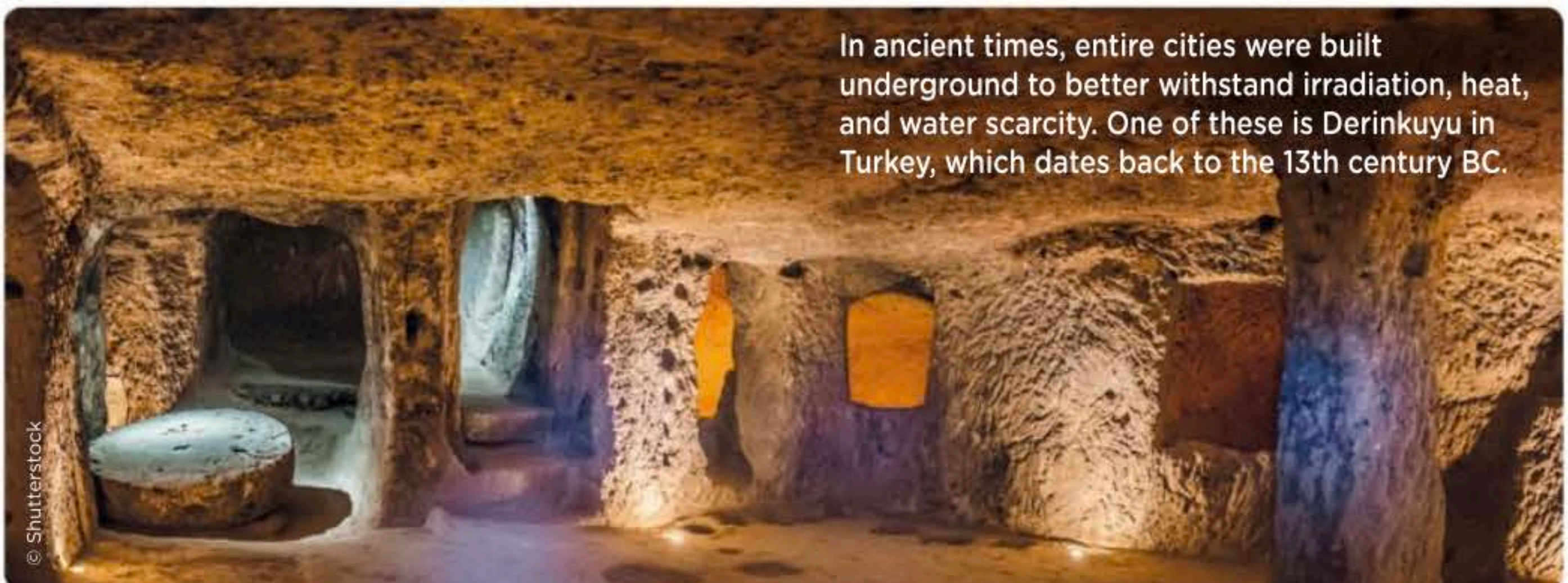
By better organizing the space, tiny houses condense all the elements of a traditional house in a much smaller area.

to be used. Such innovative approach uses no new soil, but must be planned carefully in order to maintain a proper space for the community life and avoid overbuilding.

UNDERGROUND CITIES

Another way of building that has recently been explored is to construct buildings or small parts of cities underground, as in the past. While it requires careful analysis of the land before choosing the most appropriate building sites, there are benefits to underground construction: it **doesn't alter the landscape** on the surface, and it provides natural protection

from the weather and insulation from extreme temperatures. This is really important if you live in very cold or hot habitats, like near the desert. Underground construction also **saves** costs on **maintenance**, that is the work required to keep a building in good repair: Historically, underground facilities have experienced a **lower rate of damage** than surface structures, for example from weather phenomena like storms and geological events like earthquakes.



In ancient times, entire cities were built underground to better withstand irradiation, heat, and water scarcity. One of these is Derinkuyu in Turkey, which dates back to the 13th century BC.

The 15-Minute City

EVERYTHING CLOSE TOGETHER

Today, designing cities also means building houses that are never too far from the services that people need in order to live well. These include schools, sports centers, hospitals, stores, and cultural spaces such as theaters, movie theaters, and museums. The concept of the **15-Minute City** is an example of this. It's a way of reorganizing the city and its spaces to enable citizens to have everything they need **within 15 minutes (on foot or by bicycle)** of where they live. This means citizens are able to reduce the use of cars and public transport, **decreasing traffic and air pollution**, and spend less time traveling. Rather than commuting for several hours a day,

they can use this time for leisure activities and to see family and friends. And with more services available on their doorstep, even in really peripheral neighborhoods, residents are more likely to want to spend their free time discovering and enjoying their local area, for example, taking part in activities held locally, as well as getting to know other inhabitants and thus making new friends nearby. The high accessibility of everything in a short distance and in a short time is one of the reasons why the 15-Minute City has been called the **proximity city**, referring to the closeness of all its facilities and services.

↓ The 15-Minute City has wide sidewalks and more pedestrian areas and cycle lanes than other cities, allowing pedestrians and cyclists to get around more easily.



Repopulating the countryside



➔ The Internet allows “remote work,” where people can work from anywhere rather than in their offices.

NOT JUST CITIES

New developments in the homes of the future don't just concern urban areas but also the areas outside the cities, such as small towns and **villages** in the **countryside**, **mountains**, and **valleys**. In the past, villages far from cities were often abandoned, mainly because they offered few work opportunities. Now, however, people are returning to live in them due to their more sustainable environments or the development of certain economic activities, such as **tourism** or **agriculture**. The more people move back to villages, the more new jobs can be created there, namely on farms, but also in stores, restaurants, museums, and art venues, like historical buildings

and churches. Over the years, new technological inventions have also made living outside the city much easier. Take the Internet, for instance: by connecting people all around the world, and enabling them to share information with each other, this digital network has made it simple for people far away from the cities to stay informed about everything and keep in contact with everyone. However, in order for them to continue to develop, it is important that small towns and villages offer their inhabitants what they need. Consequently, in addition to **essential services** like hospitals and schools, there must also be **job and leisure opportunities** for those who are born there and for people wishing to move from the cities to these smaller communities.

THE TRAIL GOES COLD



Well, sir, it appears that you are suspected of illegal dumping in a river outside the city.

Come on, officers, there's obviously been a mistake!



I've worked in disposal for years, and no one has ever had a problem!

I have a problem here--
HMMPH!

Better let it go, Judy!

I'm afraid that in their commendable desire to protect and serve the citizens, your colleagues have been a little overzealous!

But I want to believe that this misstep is only the result of their inexperience, and I forgive the ZPD for this embarrassing misunderstanding!

Hmm... There's no evidence against you and your employees, Mr. Skunkington. You are all free to go.

And you two had better come back to the station with us!



And there...

A squad car destroyed during an unauthorized investigation?!

And what's more, now I'm also hearing about accusations against a private citizen, without a shred of evidence?

Uh... Ah...

Didn't I tell you to **DROP** this case?

Errr...
Yes, but...

I won't tolerate any more insubordination from the two of you! Since you're incapable of staying out of trouble, you are suspended from service until further notice! **Get out!**

Right when we have a name finally!

And not just any name, Carrots! Remember when I told you about **shady** characters?

Well, Theodore Skunkington is one of them!

You don't mean...



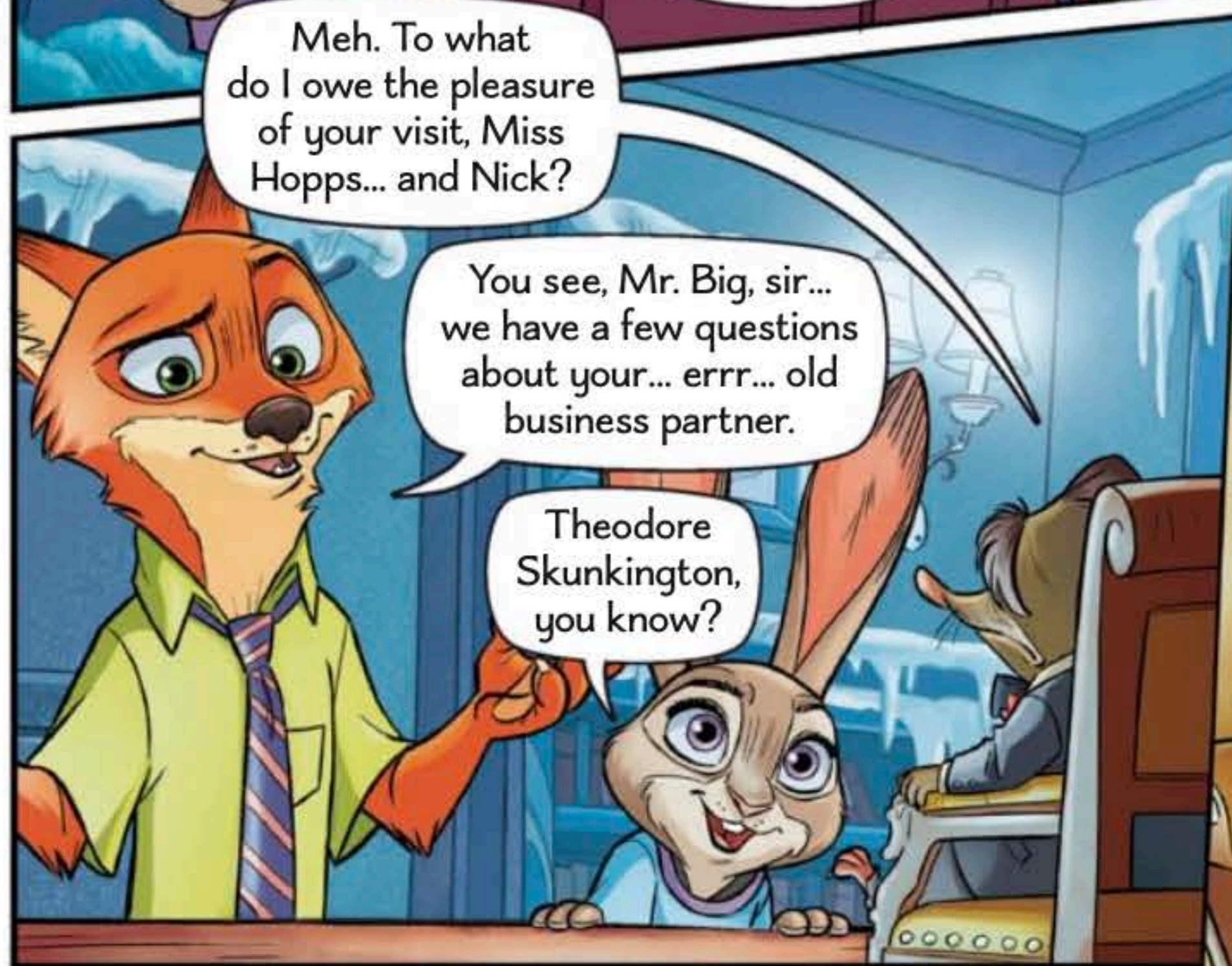
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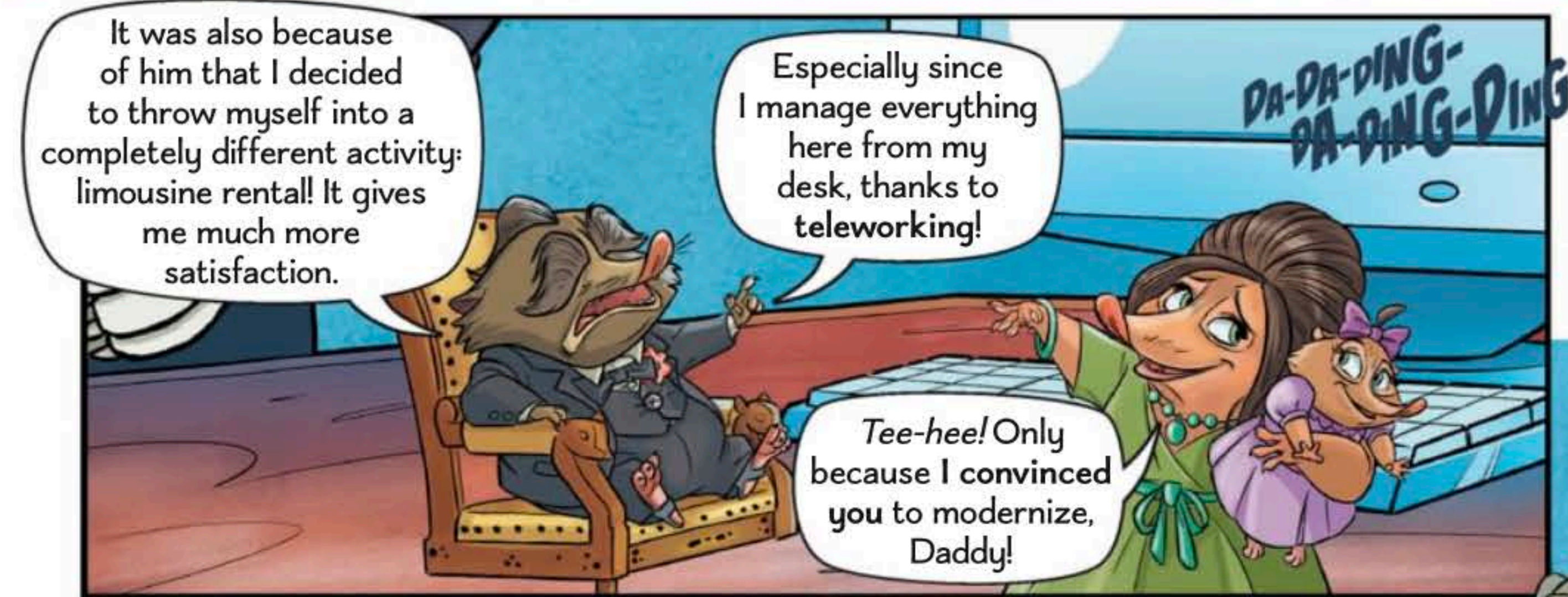










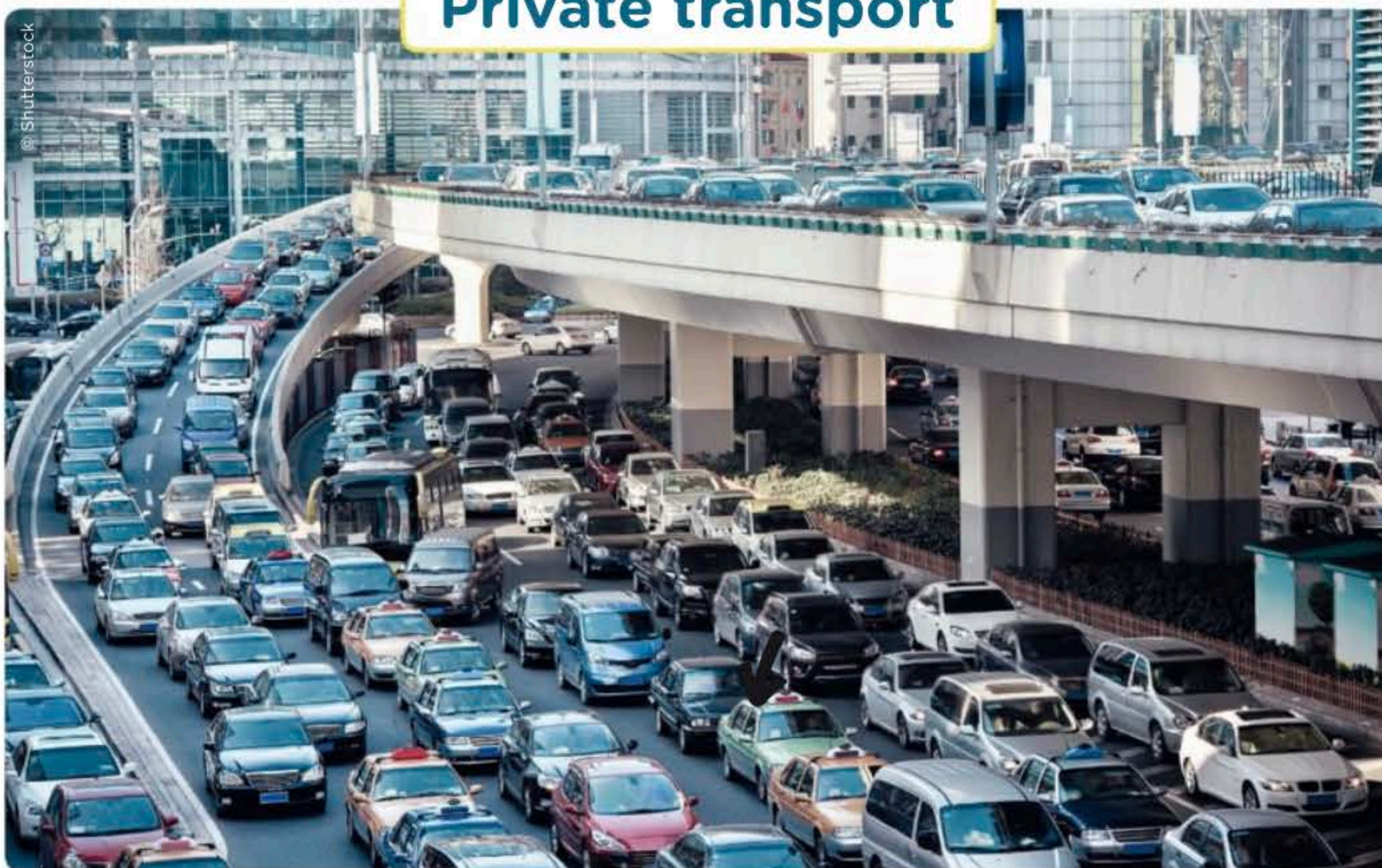


CONTINUES ON PAGE 119

GETTING AROUND TODAY

- Private transport
- Public transport and car sharing
- Electric cars and batteries
- Bicycles

Private transport



FEWER CARS AROUND

The invention of the **car** has allowed longer distances to be covered in less time than in the past, when people traveled on foot or, at best, by horse. However, in many countries today the number of private cars, those owned by individuals, is one for every two inhabitants! And it is often the case that these cars carry only one



On average, a person who uses their own car to get around the city spends seven years of their life behind the wheel!

person, or at most two people at a time. This causes more **air pollution** and increases **traffic** that, in turn, costs each traveler **more time** spent moving around. That's why, today and in the future, it is important to reduce the number of vehicles on the road by using **alternatives** to cars for getting around.

Public transport and car sharing

DRIVERLESS VEHICLES

One alternative to the use of private cars is **public transport**, like buses, the subway, and trams, because they can carry many passengers and may also be easily powered by electrical energy, which doesn't pollute. Some public transport vehicles are **self-driving**, meaning they don't have a human driver. Driverless trains and subways are relatively simple to create, because their path is confined to their own rail network and the train operator doesn't need to worry about other trains weaving in and out of its path. Self-driving cars, on the other hand, require complex softwares and sensors and a skillful

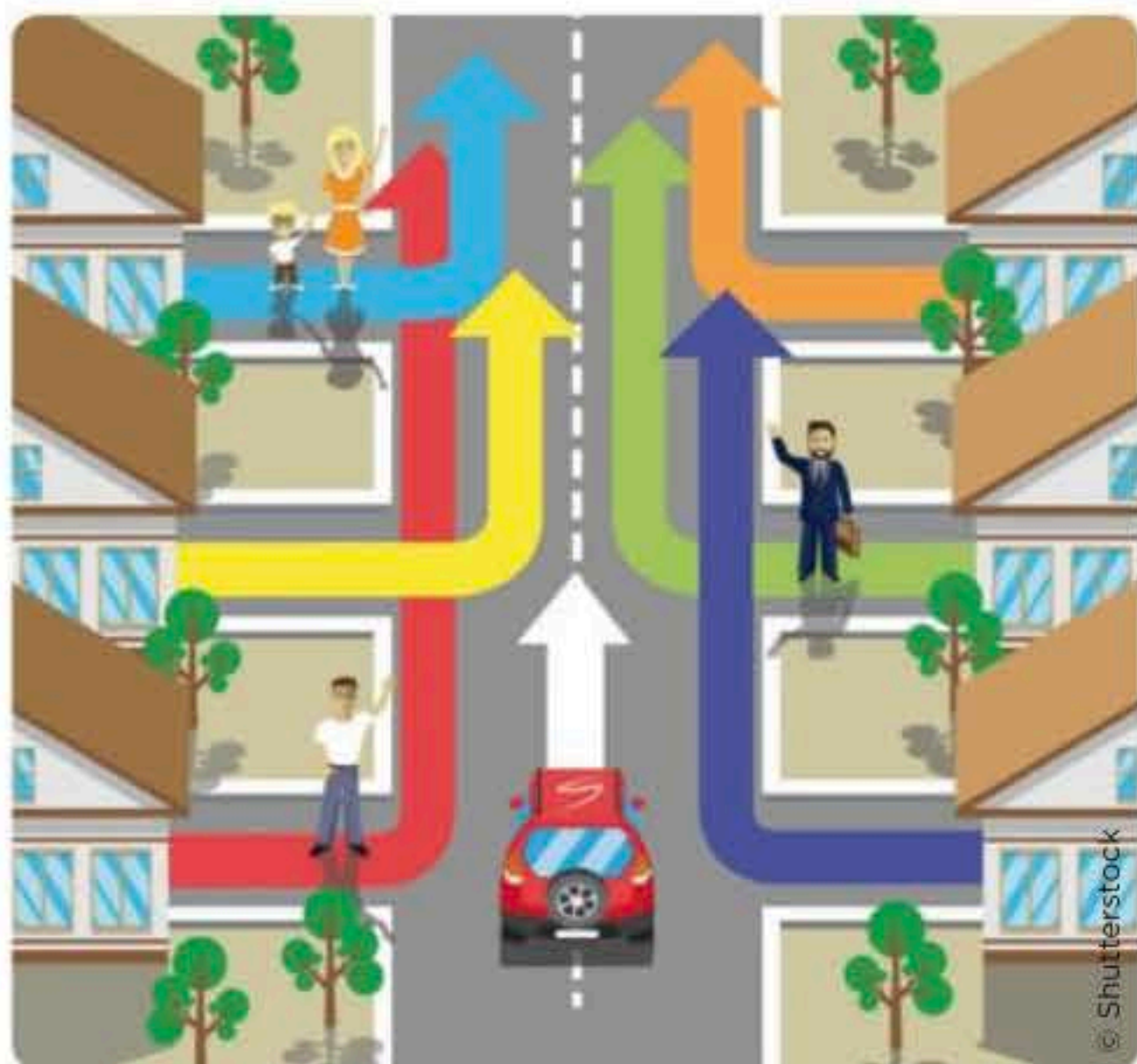


Some taxi companies already include driverless cars in their fleet. Their computers put together all the passengers' requests and work out the best route to take.

understanding of traffic conditions, safety norms, and human psychology. So, while they already exist, it will still take some time for them to become common on our roads.

CAR SHARING AND CARPOOLING

Another alternative is to use a **shared** car. When someone needs a car, they rent it for a short period and pay only for the time they use it, then they



leave it for somebody else to rent. This is called **car sharing**. Shared cars may be public, meaning that they're **available to everyone**, both residents and tourists. Or they may belong to people who don't use them much and want to lend them to others when they don't need them.

Then there's **carpooling**, where a car is used by **multiple people at the same time**. In fact, when the owner of a car needs to go to a certain place, they make the extra spaces in the car available to people who want to make the **same journey**. So it's possible to reduce pollution while traveling in a group!

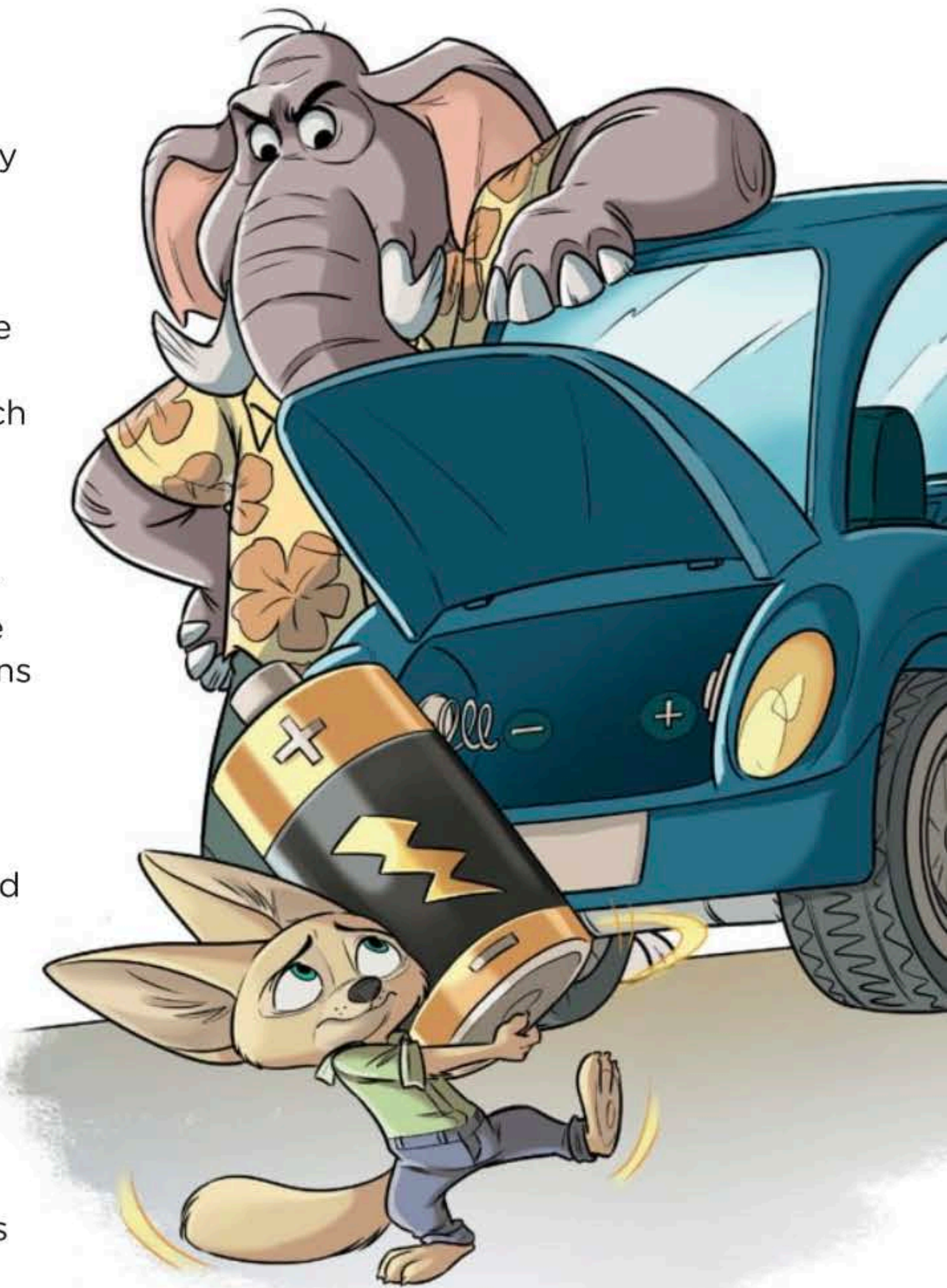
Carpooling is ideal for people who make the same journey at the same time, like coworkers or classmates.

Electric cars and batteries

THE FUTURE IS ELECTRIC

Nowadays, people who want to buy a new car can choose one with an **electric motor**. Electric cars **create much less pollution**, and they're very **quiet**. They use a rechargeable **battery**—like that of a tablet, a smartphone, or other devices—which is designed to supply an amount of power suitable for urban journeys. These are usually short trips of no more than a hundred kilometers or so, after which the battery must be recharged. Electric charging stations are used for that purpose. They look like **columns** and are located in various places around the city, available to those who need them. But the battery can also be charged by connecting the car to a special socket that you can install in your garage at home, just like any other device that needs charging!

However, this type of battery may not always be enough, especially for people who make long journeys outside the city. That's why there are also **hybrid cars** that combine an electric motor with a combustion engine, which is powered by fuels like gasoline, diesel, or natural gas.



The advantage of this type of car is that the combustion engine generates energy to power the electric battery so that the driver doesn't need to stop and recharge it. So you can use the combustion engine when you want to go faster, for example, outside the city, and the electric motor when you're driving slowly, in city centers, for instance.

← To avoid creating pollution, electric cars should be charged using renewable sources, like solar energy, as opposed to energy from fossil fuels.

Bicycles

LET'S GET PEDALING!

Bicycles are another alternative to private cars. Indeed, according to scientists, the traditional two-wheeled means of transport has many important **advantages**. First of all, cycling helps improve physical health, due to the exercise gained by pedaling. Twenty or thirty minutes a day are enough to have a positive impact on the body. But that's not all. While riding a bicycle is an activity that can be done alone, it can also be done with friends and other people who share the same hobby, improving in that way people's social life. There's more though:

getting around on two wheels is also **economical and causes less pollution**. A car not only needs fuel or electrical energy to move, but also larger roads and parking lots that consume natural land. What's more, a bicycle is easier to repair than a car, and it's also easier to check that all its parts (such as the brakes) are in good working order. Finally, it has been found that riding a bike to school, for instance, can help students' **ability to concentrate**, and being more focused helps them learn faster. Due to all these reasons, many countries encourage the use of bikes in daily life by creating urban **cycle lanes** and placing bike racks on sidewalks for cyclists to park.

Bicycles can be used by people of all ages. You just need to wear a helmet and know the rules of the road.



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WELCOME TO EVOLVILLE






Minutes later...







Nick! That bottle is identical to the one we found! And it looks like its production plant was right where we're going!

Do you mean...

That today's assignment has suddenly become much less boring? Yes, I do!

Hey... what's the rush, all of a sudden?

Chief Bogo has given us the least exciting assignment ever and you're super-excited about it?

Erm... we're just happy to be doing our job as cops, you know?

Say, do you know anything about the place where we're headed?

I just know it's part of the new mayor's city improvement plan!

Yeah. Mayor Berenice Baribal's very attentive to environmental issues! As soon as she was elected, she started her mandate by building Sustainable Street, and then...



Ten minutes later,
in the new city district...



Shortly after...

Ahem...

Hello,
citizens!

With its integration of different environments and animals, Zootopia has always been a metropolis that looked to the future!

Well, the time has come to announce that the model it represented now belongs to the past!



This is really great!

Ssh!
I wanna hear!



What do you mean, Madam Mayor?



That a modern city doesn't just mean very tall buildings, like those you see everywhere in the city centers! The well-being of those who live there comes before everything else.



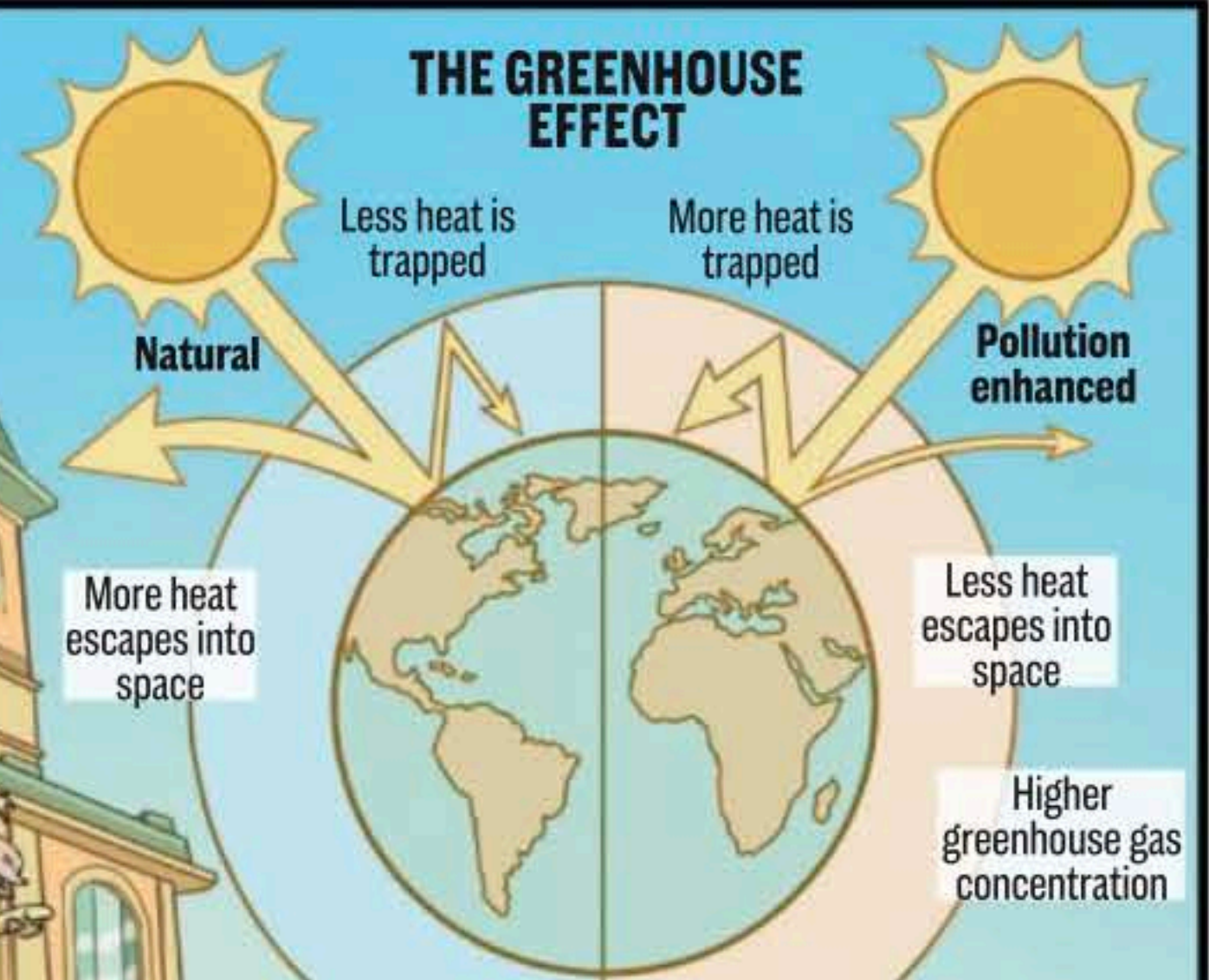


Let's face it: in the times to come, our city will have to be prepared to face some issues!

"And I'm not just talking about the huge and polluting amounts of energy necessary to maintain the climates in its districts..."

"Every day, more and more mammals are flocking to Zootopia from faraway places: places that are increasingly compromised by rising temperatures and natural disasters resulting from climate change!"

"This phenomenon is caused by the excessive greenhouse effect induced by the very pollution of the atmosphere!"



"To welcome these new citizens, of course, we need to expand the city even more, causing an ever-greater impact on the surrounding environment..."



Wow, day-to-day life in Zootopia is harder than I imagined!

True!

"At the same time, living in a metropolis like Zootopia, with huge distances between the districts where people live and their workplaces, comes with wasted time, expenses, pollution... and stress!"



My promise, if I was elected, was to find a remedy for all this! Well, I have fulfilled my promise this new district is destined to serve as a model for a better Zootopia: a place built not only on eco-friendly principles but on more animal-friendly ones as well!



We are starting our renewal here, just a few kilometers from the metropolis! The solutions are all around you!



"Solutions such as tiny houses, which save on living spaces by exploiting small, unused spaces..."

Hello, there!

Hello!

But most important, a place where, instead of hours, everything you need is reachable in no more than 15 minutes!

A really inclusive city intended for every animal, regardless of size, origin, and species! In short, *Evolville* is a more evolved city fit for everyone!



CLAP

In a way, it will be just like Bunnyburrow!

CLAP
CLAP



I sense somebody's becoming a fan of the mayor!



THE CLIMATE CRISIS

- Climate change
- Humans and fossil fuels
- The effects of climate
- Climate refugees

Climate change

WILD WEATHER

Climate is the set of weather conditions, such as temperature and rainfall, in a particular geographic area over a long period of time. To determine the climate of a place, scientists need to study its weather conditions for **decades**. Over the past 150 years Earth's temperature has risen rapidly and is continuing to do so. This phenomenon, called **global warming**, causes extensive damage to ecosystems, the organisms living in them, and the substances they need to live. Some examples are the melting of ice at the poles and the oceans heating up, endangering plant and animal species that live in



↑ Warmer air holds more moisture, and this may increase extreme precipitation, often with record-breaking floods as catastrophic consequences.

those habitats. Global warming can also cause an increase in **extreme weather events**, like hurricanes, floods, and heat waves or exceptionally cold spells.

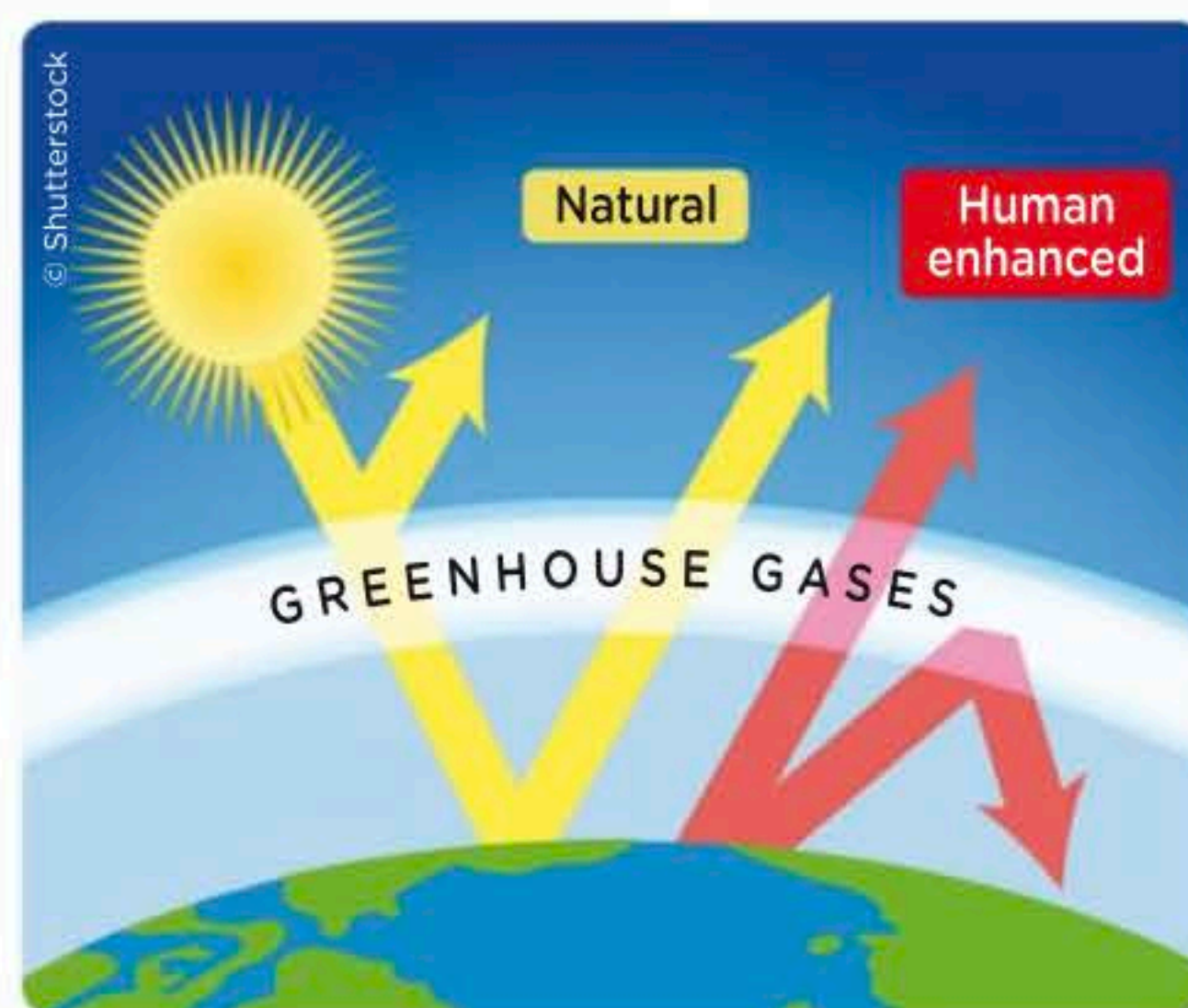


Humans and fossil fuels

WHAT ROLE DO HUMANS PLAY?

Earth stays warm due to a phenomenon known as the **greenhouse effect**. During the day, some of the gases in the **atmosphere**—the thin gaseous layer surrounding the planet—let the sun's rays through, while at night they retain some of the heat from Earth's surface. Those gases are known as **greenhouse gases**, and **carbon dioxide** is among them. The greenhouse effect is currently increasing due to humans, since many activities, like manufacturing goods, raising livestock, growing crops, and traveling in vehicles such as cars and planes, release huge amounts of greenhouse gases into the air. This causes an increase in

the heat trapped in the atmosphere, resulting in the **climate warming up**. That's why it's important to reduce emissions of these gases.



Without the greenhouse effect, Earth's average temperature would be well below freezing. When it exceeds certain limits, though, the climate warms up, and this can damage life on the planet.

FOSSIL FUELS

Machines and vehicles used by humans are powered by substances called **fuels**, which produce energy when burned. Some of these are known as **fossil fuels** because they formed from ancient plants and animals that were buried beneath layers of rock after their death. Over

millions of years, they decomposed, eventually transforming into three of the fuels most frequently used by humans: **coal**, **petroleum**, and **natural gas**. However, burning these fuels produces large amounts of greenhouse gases, which warm the planet, endangering its life. That's why some countries are committing themselves to using fewer fossil fuels and, thus, reducing global warming.

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Coal is derived from the decomposition of plants, and petroleum and natural gas from that of small marine organisms.

The effects of climate



➔ Approximately half of Earth's surface that isn't covered by ice now consists of arid land, including deserts.

DESERTIFICATION

Another consequence of global warming is the increase in **desertification**. This occurs when fertile lands, rich in natural substances that make them suitable for farming and settlements, are transformed into arid areas due to high temperatures, lack of rainfall, and human activity. These are places, such as deserts, without water and resources, where life is very difficult for humans, plants, and animals.

Desertification is caused by both the increase in global warming and humans intensively utilizing the land and depleting its resources. For example, by overusing it as grazing

for livestock or cutting down too many trees for timber, causing woodland and forests to disappear. What's more, humans build cities and roads, covering the soil with **concrete**, which prevents water from being absorbed into the ground, causing millions of microorganisms in the soil to die.

All these activities strip the soil of its resources, leaving it nutrient-poor and causing deserts to continue to expand. Indeed, desertification has become widespread in various parts of the world, especially in areas where it rains much less, such as Africa. This is why it's progressively **more difficult to produce food** in those areas, and consequently local people struggle to survive.

Climate refugees

FORCED TO LEAVE

Climate change can have very serious consequences for both the planet and humans. Indeed, every year people are forced to leave their land and their homes. These people who migrate, that is move from one place to another, as the conditions of the area in which they live get worse and worse are called **climate refugees**. For example, desertification can cause the soil to lose its natural nutrients so that it can no longer be farmed, resulting in food shortages. Or melting ice can cause the **sea level** to rise, making it difficult to continue to live in certain coastal locations. Other times, a **natural disaster**, like a large flood, can destroy areas where there were houses, fields, and grazing land. For all these reasons, inhabitants



of those area are forced to look for somewhere else to live. Usually, they choose to move inland in their own country or to a neighboring country for convenience. However, sometimes they embark on very long journeys to reach areas with milder temperatures that still have favorable conditions to grow plants and raise livestock.

↓ Throughout the world, natural disasters are among the main causes of human migrations.



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TRIPPING AROUND

Well, I think all this seems very positive for the city, to say the least!

Now I and Mr. Snoutersen, the architect who designed the new district based on the most advanced building and energy requirements, will answer all your questions.



Okay guys, the mayor will have finished the press conference any minute now. We'll have a lunch break of about an hour and then we'll head back to the city center!

Excellent, Officer Rhinowitz!

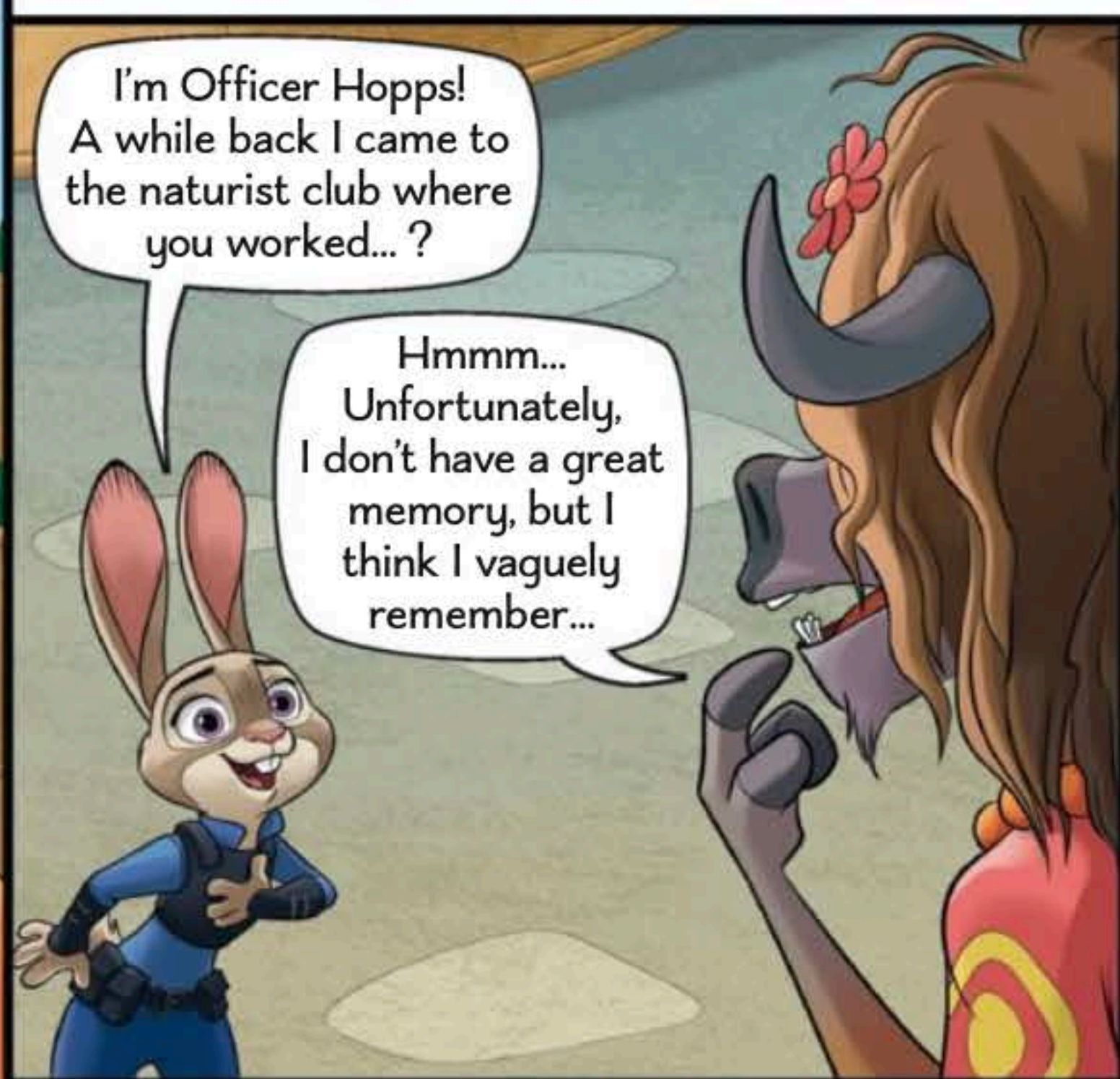
We have a few ideas about how we'll spend that hour!


C'mon! It's time to make the most of being here and start looking for the old Snuzzle Pops factory!

If it's been pulled down, it's not going to be easy! Unless you have some idea where we should start... ?

No idea, I have to admit. We know nothing about this place!

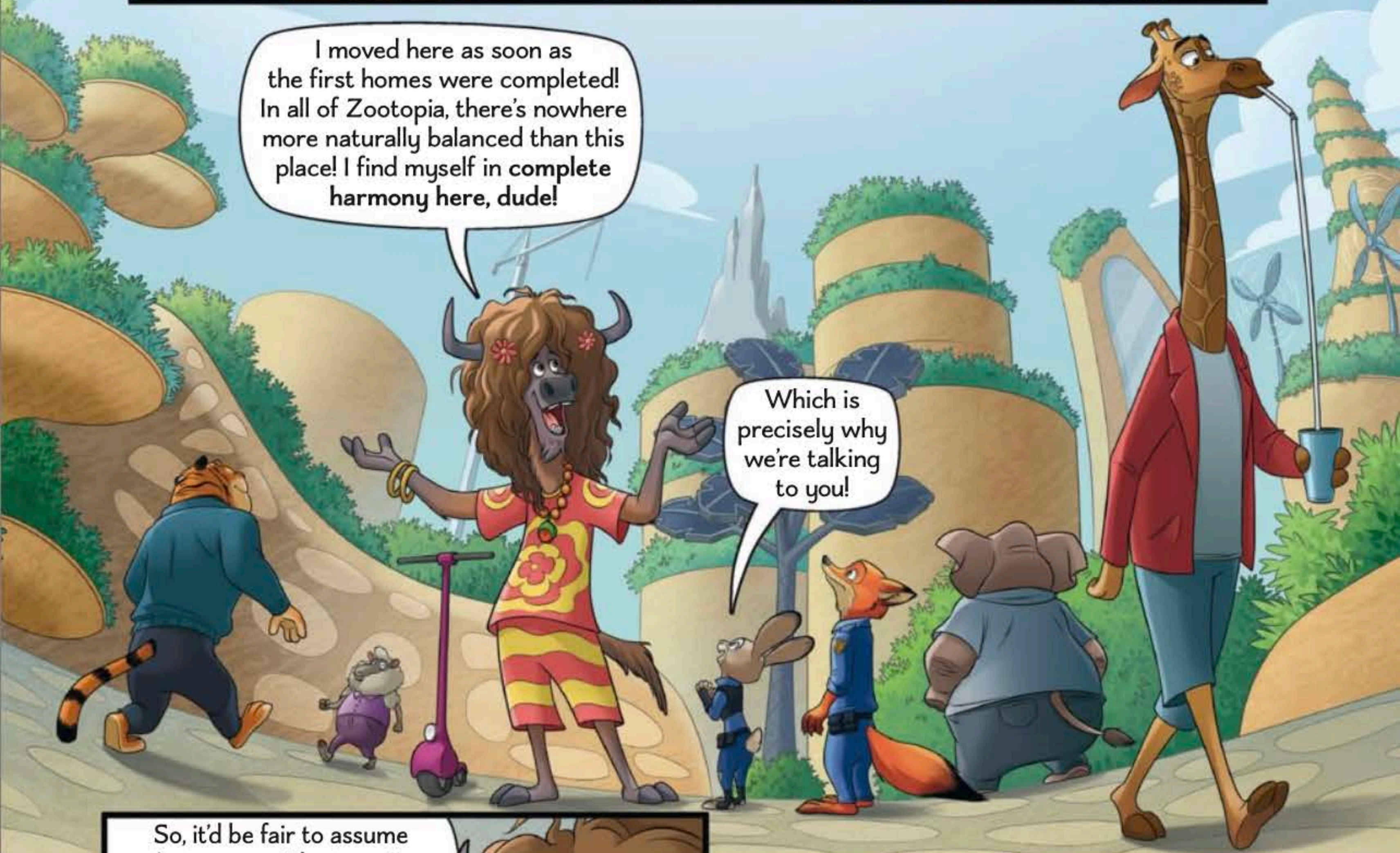
On the other hand, if I'm not mistaken there's someone we know over there.





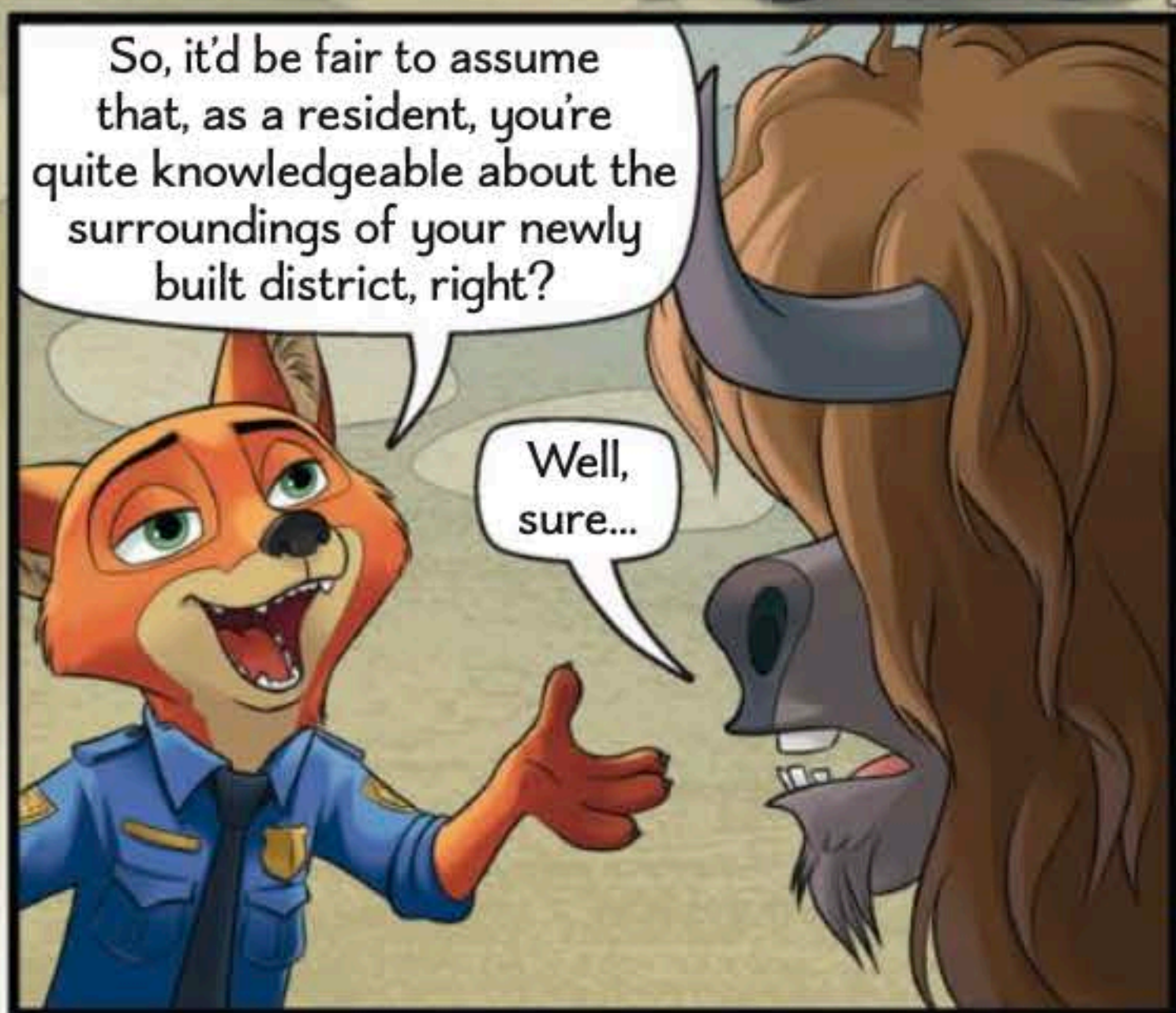
You were leading an investigation into one of our regular clients along with this other officer, but back then he was wearing a green shirt and kind of a loose necktie!

Exactly!




I moved here as soon as the first homes were completed! In all of Zootopia, there's nowhere more naturally balanced than this place! I find myself in complete harmony here, dude!

Which is precisely why we're talking to you!



So, it'd be fair to assume that, as a resident, you're quite knowledgeable about the surroundings of your newly built district, right?

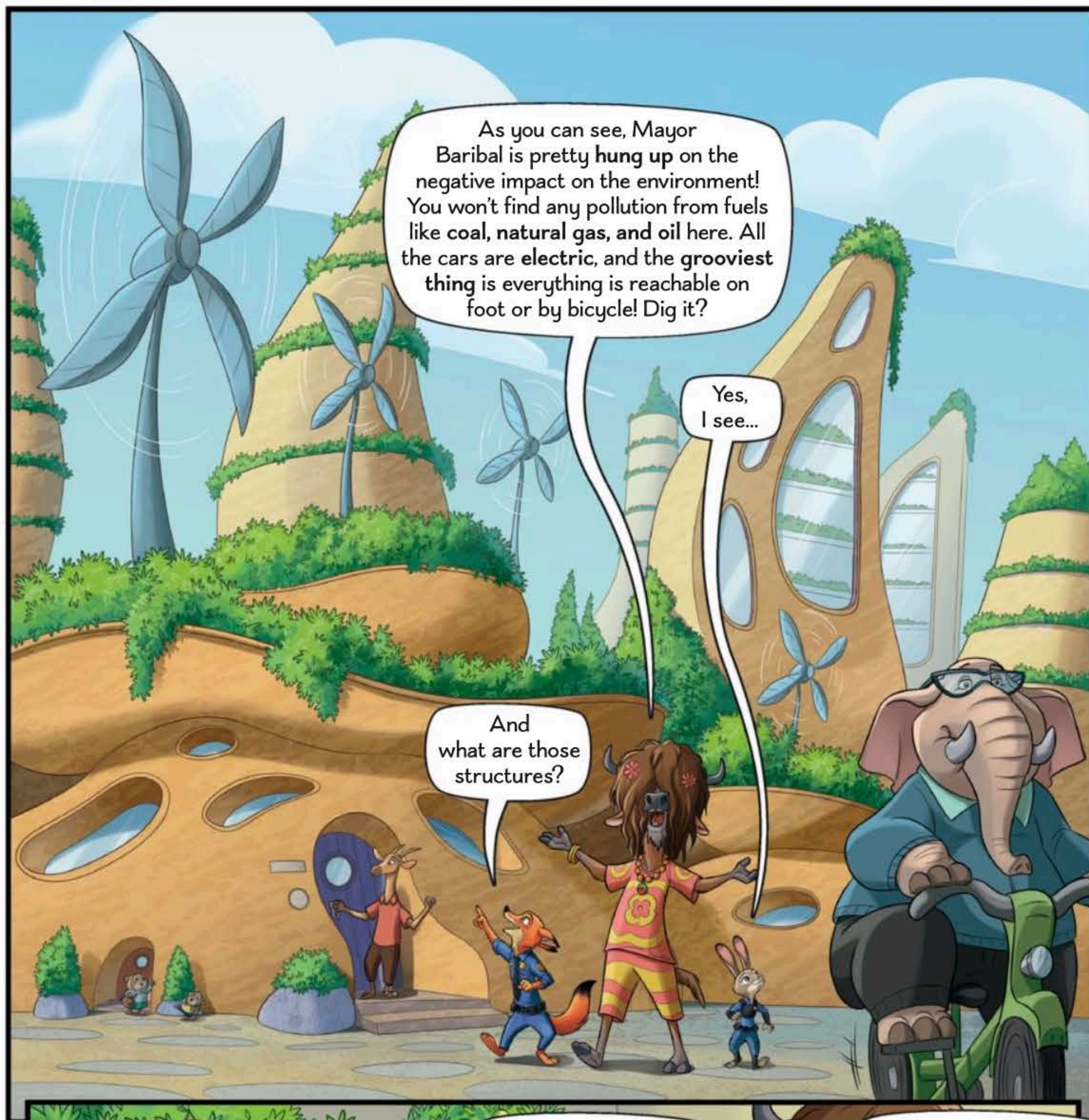
Well, sure...



Say, would you like to take a tour?

Hm. Would we?

Yes! It's the quickest way to have a look around!



As you can see, Mayor Baribal is pretty hung up on the negative impact on the environment! You won't find any pollution from fuels like coal, natural gas, and oil here. All the cars are electric, and the grooviest thing is everything is reachable on foot or by bicycle! Dig it?

Yes, I see...

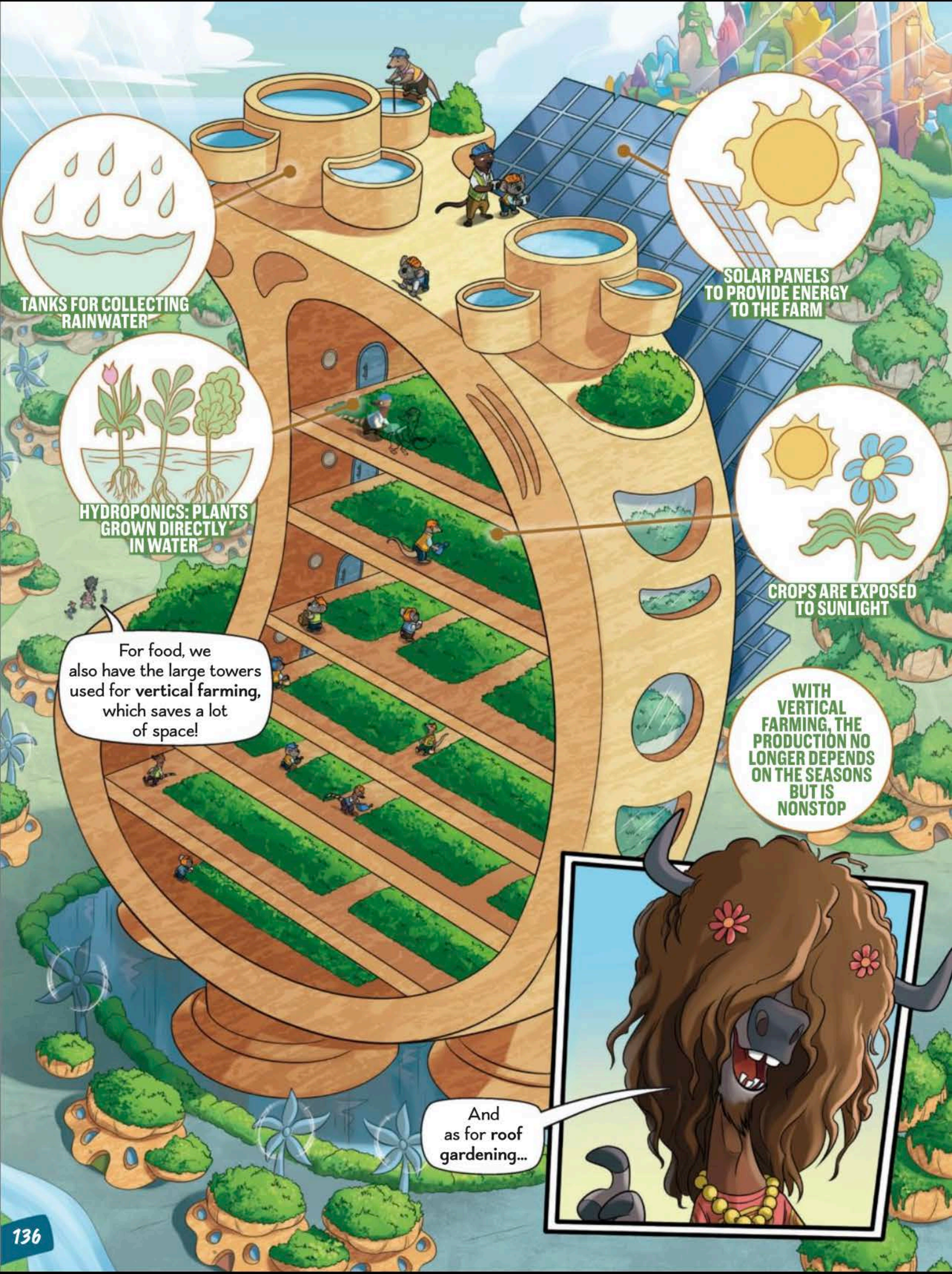
And what are those structures?



They're, like, our houses, man! In Evolville, every single roof is covered in plants!

It's good protection when it's too hot and too cold, from bad weather and frost. Plus, they absorb rainwater!

And they're great for growing food, as far as I can see!



TANKS FOR COLLECTING RAINWATER

SOLAR PANELS TO PROVIDE ENERGY TO THE FARM

HYDROPONICS: PLANTS GROWN DIRECTLY IN WATER

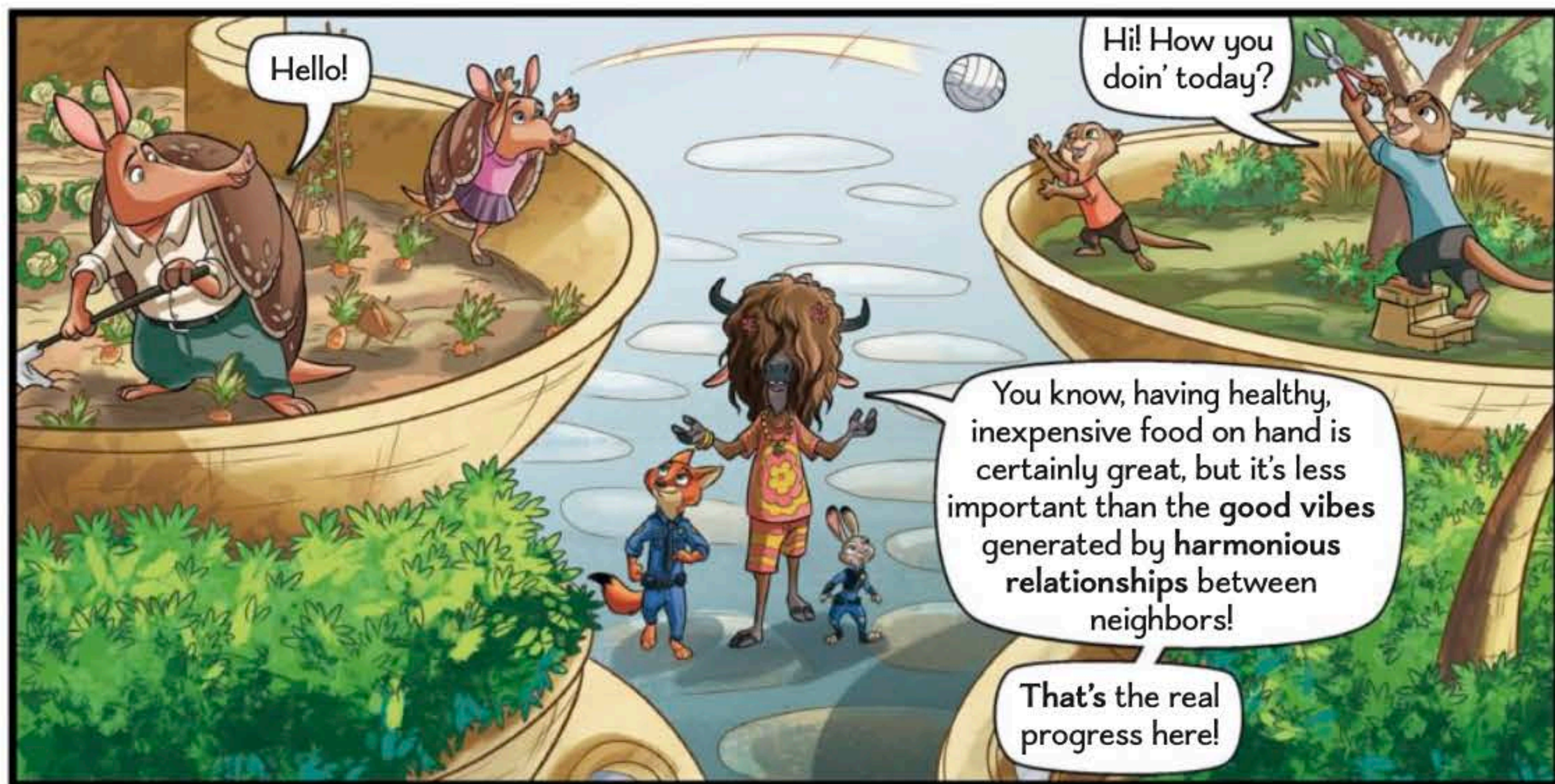
CROPS ARE EXPOSED TO SUNLIGHT

WITH VERTICAL FARMING, THE PRODUCTION NO LONGER DEPENDS ON THE SEASONS BUT IS NONSTOP

For food, we also have the large towers used for vertical farming, which saves a lot of space!

And as for roof gardening...







Both produce clean energy, from inexhaustible and non-polluting renewable sources like the wind and the sun!



Whoa, that's impressive!

Yeah, totally far out, isn't it?



I dunno... Going back to sources like the wind feels like a throwback to primordial times, don't you think?

Well, that's what we saw in my parents' fields, remember? It seems like that's the direction progress is taking!

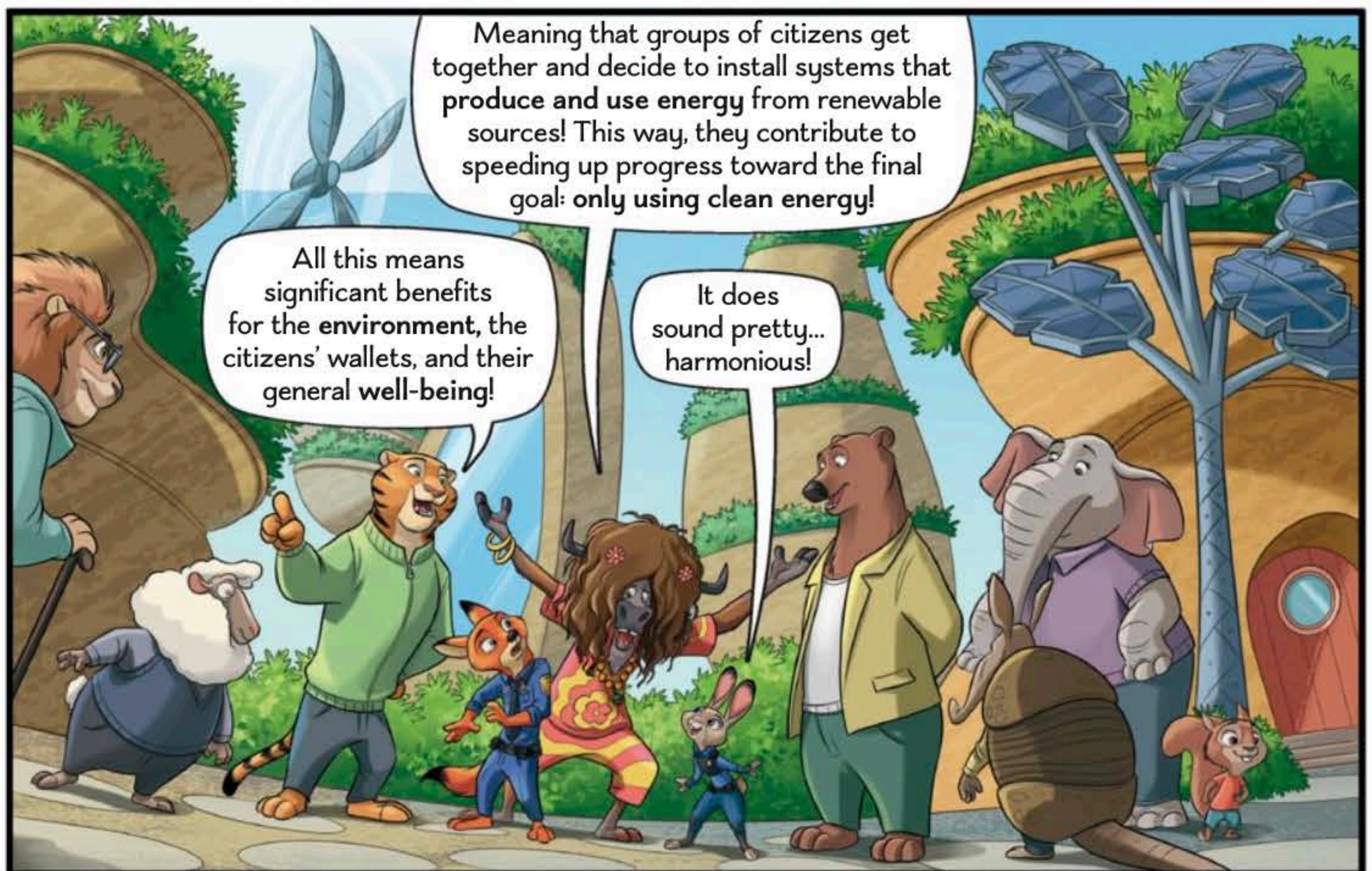
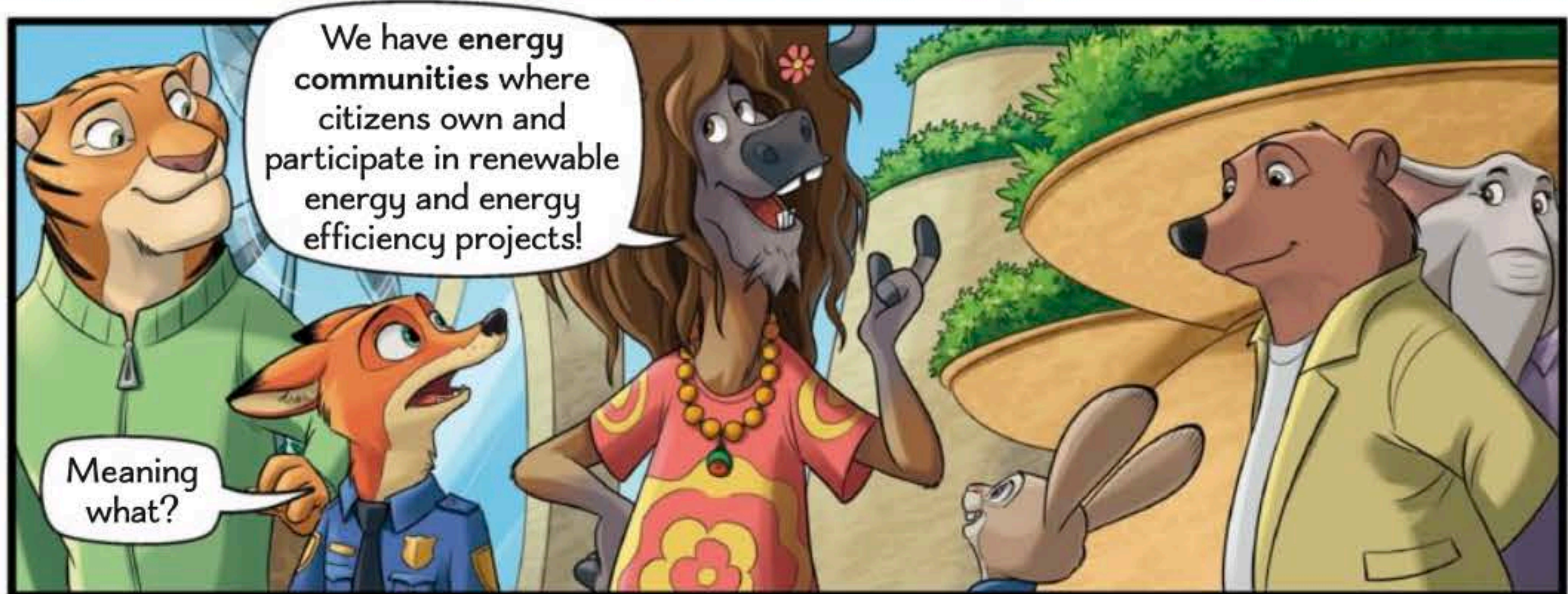
Rightly so: Evolvie's motto is "Going back to go forward!"



I love the strong sense of community here. It almost feels like home!

I agree, although those sure aren't bunny rabbits!

Ah, community is the key word here!





CONTINUES ON PAGE 145

A NEW KIND OF ENERGY

- The energy transition
- Renewable sources
- Energy communities
- Hydrogen

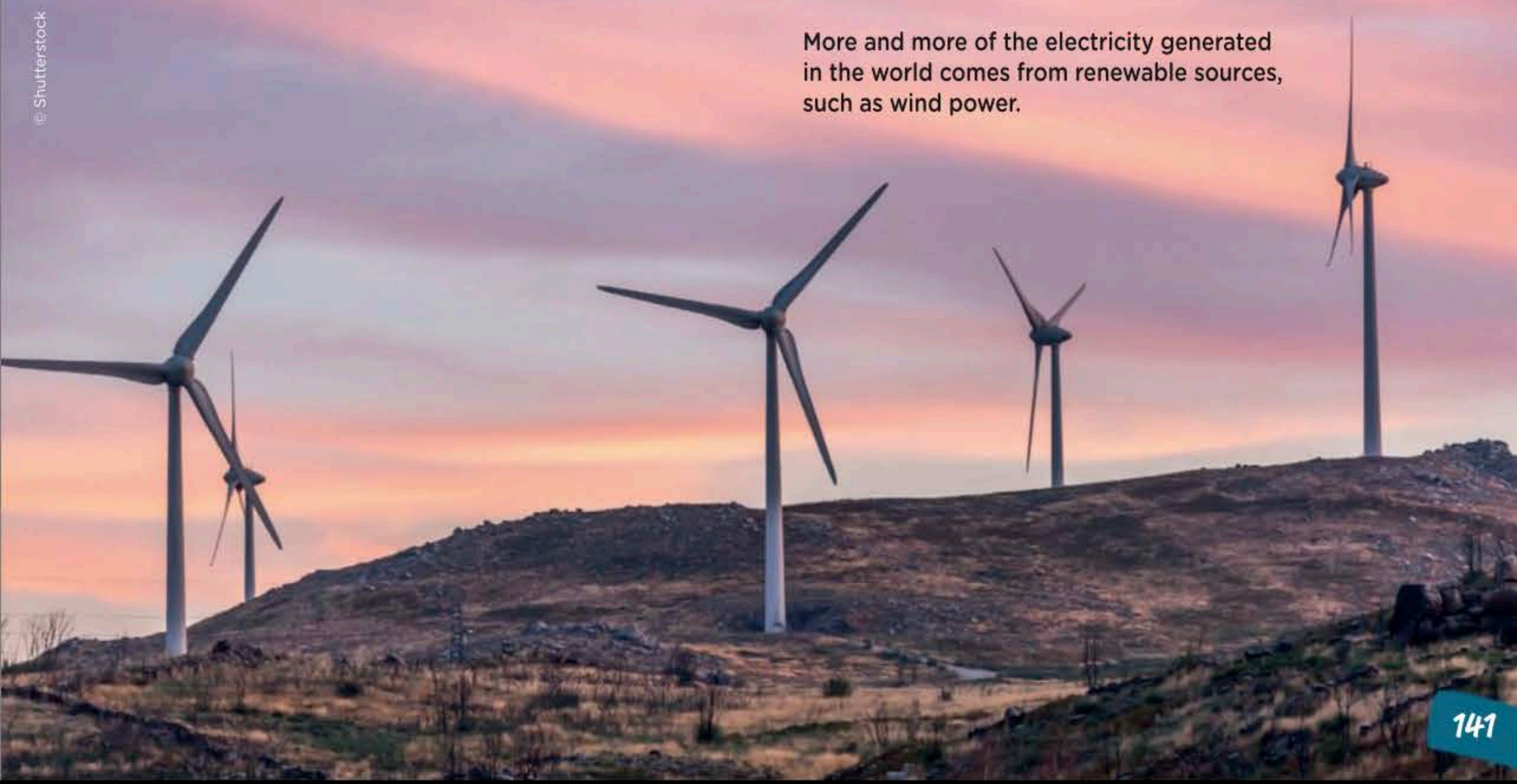


The energy transition

ENERGY OF THE FUTURE

Until the end of the twentieth century, the energy produced by humans came mainly from fossil fuels, nonrenewable sources that produce greenhouse gases. However, Earth's population is increasing and therefore requires more and more energy. To respond to current energy needs, it's better to use **renewable energy sources**. In fact, they **regenerate** and, consequently, even when large amounts are used up, there's no risk of them running out; also, they're **environmentally friendly**, since producing and using them results in less pollution. Furthermore, they're steadily becoming **cheaper and more accessible**, as the cost of generating renewable power has fallen sharply in recent years thanks to technology improving, production increasing, and supplies being managed more efficiently.

More and more of the electricity generated in the world comes from renewable sources, such as wind power.



Renewable sources

WHAT ARE THEY?

Renewable energy can be obtained from various types of natural resources available in the world. One of the most important energy sources is the sun. Its rays can be captured by **solar or photovoltaic systems** to generate energy. These systems consist of high-tech panels, arranged on the roofs of buildings or on the ground, which can transform the sun's heat into electrical energy.

Wind, too, can be used to generate renewable energy, known as **wind power**, by moving wind turbines that produce electricity. So can water, both from ocean currents and from rivers and lakes. In this case, the energy is generated in **hydroelectric power stations**, which transform the power of moving water into electrical energy. Last, energy can even be produced from waste. This is called **biomass** and consists of organic substances, such as food waste, that generate energy when burned.

THE ENERGY TRANSITION

The move from using nonrenewable energy sources to renewable ones is called **energy transition** and is already underway. In 2030, the amount of energy from renewable sources will be four times as high as it is today. However, more and more energy is predicted to be needed, particularly in cities, where many people live. That's why it's important to use **technological advances** to seek new and efficient ways of using



↑ An electric car can be charged using the wind or the heat of the sun transformed into energy by wind turbines or solar panels.



renewable energy sources, and storing the power generated so it can be used when required.

Energy communities

ENERGY FOR ALL

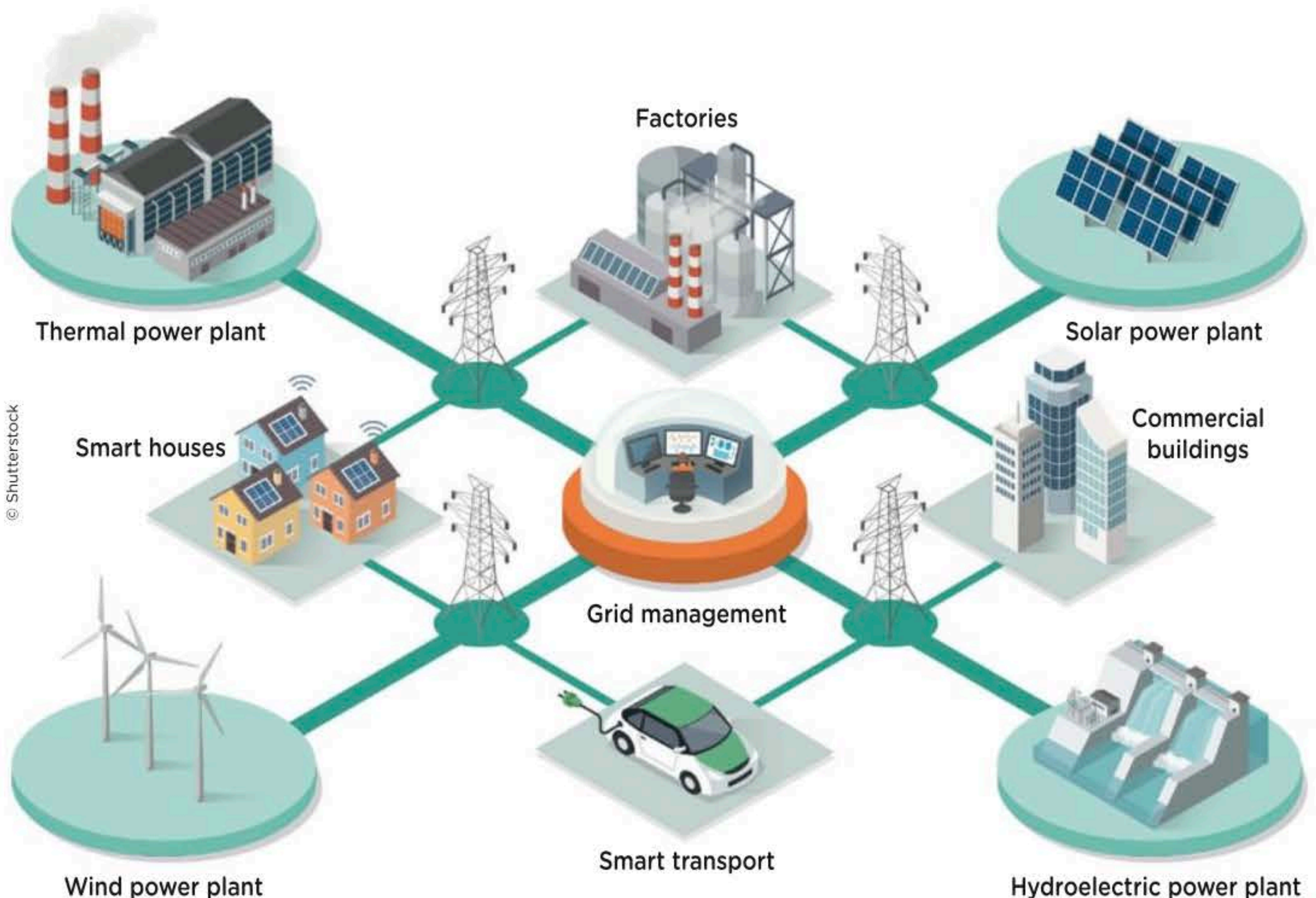
The use of renewable energy sources has resulted in the creation of **energy communities**. These are groups of people—families, municipalities, companies, and commercial entities, such as stores and restaurants—that produce, use, and share energy with each other, relying on the natural resources available where they live. Each group builds systems to generate renewable energy, for example, solar panel systems, and the energy produced can be used immediately or stored to be used when needed.

Additionally, the **energy is shared**, meaning that when a member of

the group produces more than they require, they can give it to someone else who needs it. This reduces costs, because each system produces energy for several families and businesses instead of a single home or store. As a result, energy is **more easily accessible**.

This is why energy communities are important and will become even more so, while large power stations, including those in other countries, may become less necessary. In fact, people will be able to generate energy themselves and share it with others, enabling **savings and causing less pollution!**

A *smart grid* is a network that distributes energy intelligently among the members of an energy community.



Hydrogen

In the future, hydrogen could be increasingly used as a fuel: hydrogen-powered planes, for example, which are as fast as traditional ones, would emit only water, which doesn't pollute.



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A FUTURE SOLUTION?

One renewable energy source that is increasingly being used is **hydrogen**. Hydrogen is a chemical element, a pure substance, which can be used as a **less-polluting fuel**, since greenhouse gases aren't emitted during energy production fueled by hydrogen.

Hydrogen can be used instead of gasoline as a fuel for vehicles, but also in place of coal in certain industrial plants. Fortunately, the universe contains large amounts of this element; in fact, it's the most abundant one of all. For example,

on Earth it can be found in living organisms and water, which is actually composed of oxygen and hydrogen. However, it's very difficult to find hydrogen in its pure state, not combined with other substances. That's why, to be used, **it needs to be obtained in other ways**, such as extracting it from water by **electrolysis**, a process that uses electrical energy to separate hydrogen from oxygen. And when that electrical energy is generated from renewable sources, the hydrogen obtained from the process is also called renewable. It's currently still expensive to use hydrogen, but in the future it could become one of the most important energy sources.

LOST AND FOUND

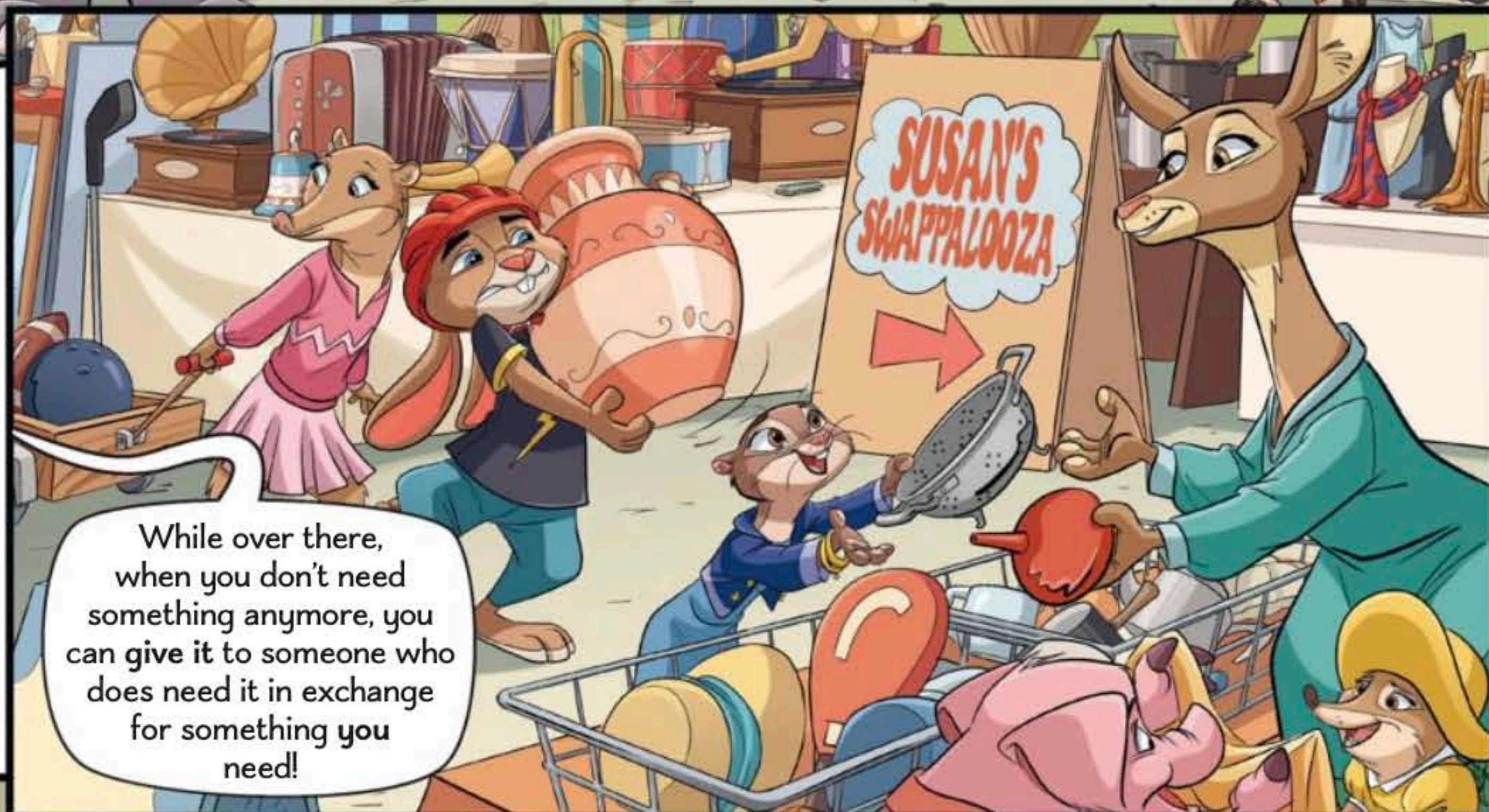
So, this is the neighborhood flea market?

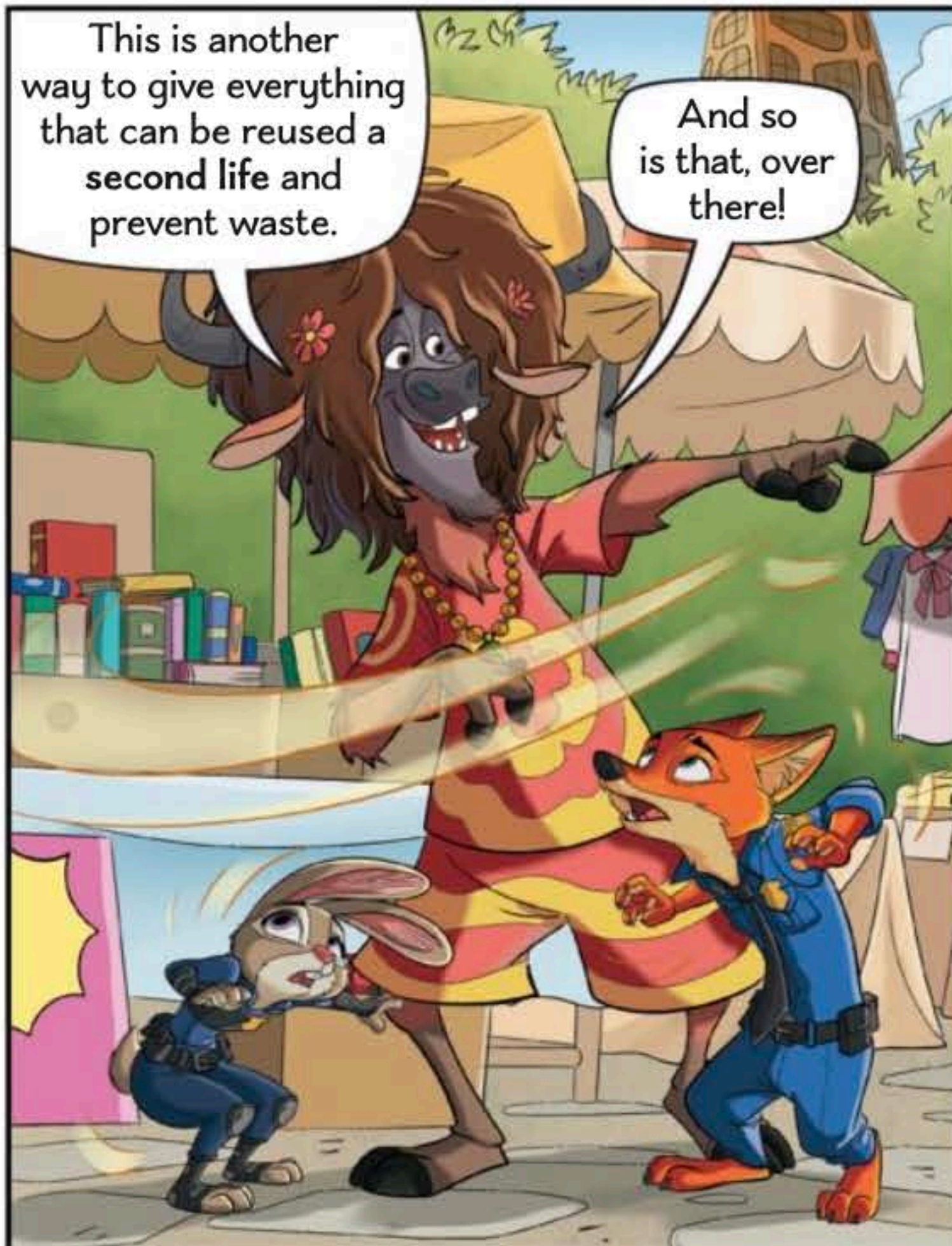
Oh, not **THE** market, but one of many! There are lots more spread over the district.

Remember: in **Evolville** everything is arranged to be easily accessible!









"Everyone places the skills they have at the service of others, in exchange for another service!"

"Tomorrow morning I have to paint the walls of my coworker's home. And she'll paint a portrait of me!"

Coworker... ?

Sure!

"We share work spaces here too!"

PAT
SPAT



In short, the watchword in Evolville is flexibility!

This is all very nice, Yax, but...

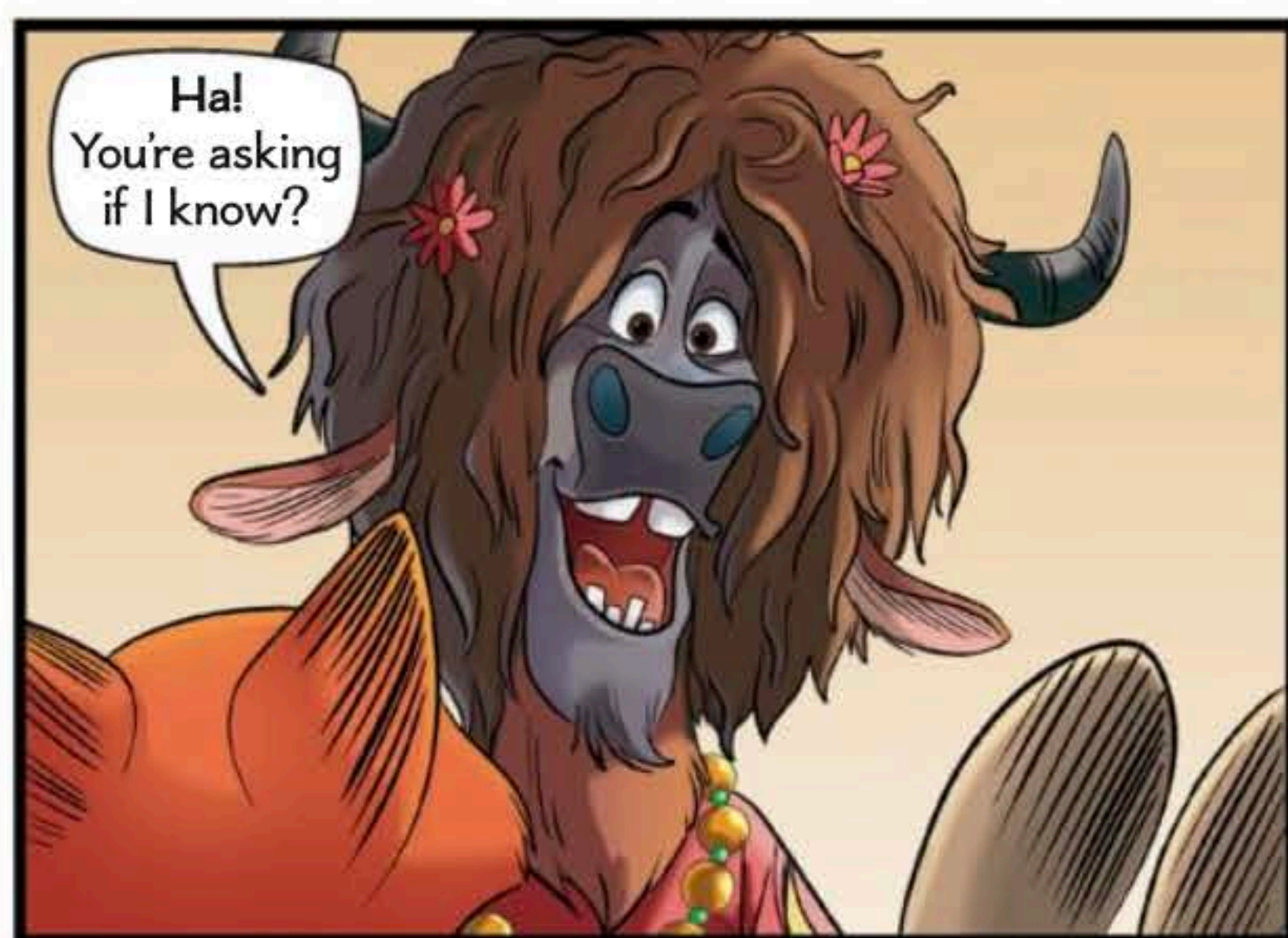


... we were actually looking for the old Snozzle Pops factory!



The old fizzy drinks factory that used to be here, before Evolville was built?

Yes! Do you know where it is?



Ha! You're asking if I know?



Huhhh...







She's not kidding around!

Neither are we!



Eek!

Good luck catching me, losers!

Wow! A chase!

?!

Who needs luck...





... when you have a good pair of legs for jumping?

ORGANIC FERTILIZERS

POW!

Yikes!

BONK

COMPOST

HA!
Missed me, cottontail!

Bye-byyyye!

Huff. Looks like she's slipped away from us yet again!

Whoa! She sure was in a hurry!

Not this time!



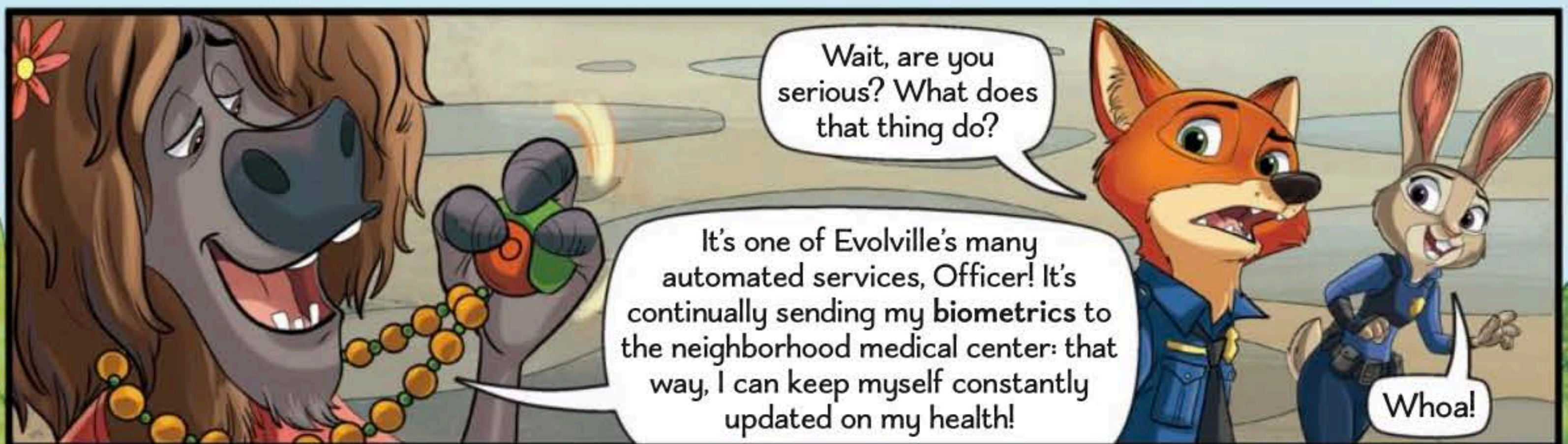
See? She went that way!

Compost tracks!



After all these emotions, I need to check my energy is still harmoniously aligned!

≠Pfah!≠
You're not the only one!



Wait, are you serious? What does that thing do?

It's one of Evolville's many automated services, Officer! It's continually sending my biometrics to the neighborhood medical center: that way, I can keep myself constantly updated on my health!

Whoa!



Evolville sure is a smart city!

Yep. I wish I was as smart as a city!

Me too. That way, we'd be able to find what we're looking for...

Whoops! I take it back!

I'm no expert on architecture, but...



That place definitely looks like a former factory, don't you think?

What, you mean the new playground?



It appears this place is being reclaimed and gradually converted into a public space!

Don't look now, but there's something else appearing, over there.



Well, well, isn't this a surprise!

CONTINUES ON PAGE 161

THE SHARING ECONOMY

- Shared spaces and services
- Living and working together
- Time banks
- Common goods

Shared spaces and services

WHY SHARE?

The **sharing economy** is a way of living in which all sorts of things are shared. For example, **goods**, or objects, **spaces** like homes and offices, and even **services**, such as nanny shares. But why share things instead of buying them? First of all, sharing—hiring a vehicle or renting a space, for example—is more economical and it also allows more efficient use of available resources.

That's because sharing lets the same good be used by more people for longer, avoiding that good staying unused. Moreover, fewer of those objects need to be produced, as just one is enough for several people, resulting in **less energy being consumed**, less resources being used, and less pollution.

Smartphone apps are at the heart of the sharing economy. Some tackle food waste by selling leftover food from restaurants and shops at discounted prices.



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Living and working together

COHOUSING

In addition to useful objects and means of transport—like bicycles, cars, and scooters—it is also possible to share house spaces. This is called **cohousing**. In practice, people decide to live in certain buildings and open spaces **collaboratively**, meaning they use them all together. These can be outdoor spaces like gardens or indoor ones like kitchens, play areas,

gyms, laundries, and so on. A single space is used by several people, instead of each person using their own smaller one. For example, the inhabitants of the same apartment block may choose to have a vegetable garden together. This allows them to share the production and also the work and expenses to keep it clean and tidy. Cohousing also helps people get to know their neighbors better, improving socialization, and perhaps even making friends!

COWORKING

Many individuals and companies find it useful to also share work spaces. This is called **coworking** and allows several people to use **the same space** even when they do **very different jobs**.



Coworking also allows people to exchange ideas and knowledge to create new projects together.

What is important is to identify similar services that they all need: for example, an Internet connection or a reception service for clients. The shared spaces can also consist of several different rooms—such as meeting rooms, waiting rooms, libraries, kitchens, and even break rooms—that can be used for activities, but also for people to get to know each other and **establish new relationships**, important both for work and private life.



Time banks

GIVING TIME

Today, not only can goods, services, and spaces be shared, but even time can be given and received, through a **time bank**. It works a little like a conventional bank, which brings together people who lend money and those who receive it, but in this case it's time that's exchanged, and anyone can decide to participate. Time is **measured in hours**, and the people who make their time available offer to do something they're skilled at. In exchange, they can receive time from someone else skilled at a different activity. For example, an English teacher might make two hours of private lessons available every week. Their local time bank

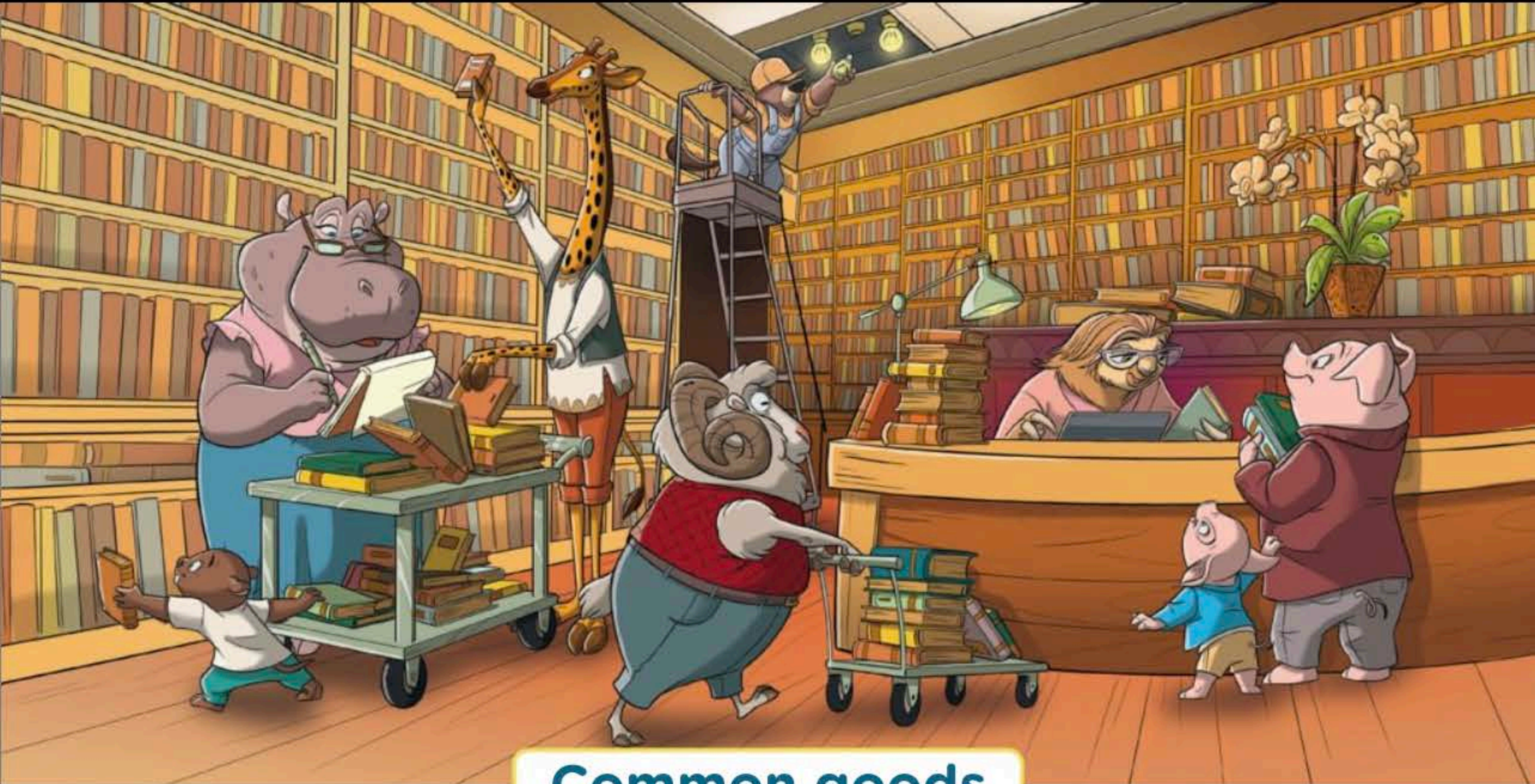
would put the teacher in touch with the person needing those two hours of lessons, and in return the teacher would receive two hours of time from someone else who can do something for them, such as pruning the plants in their garden or painting a wall in their home.

Time banking has also been used in schools since the late 1990s. A student who is good at a certain subject can help a classmate who's struggling and, in exchange, can receive lessons in a subject they find more difficult. In the end, time banks are a very efficient way of **helping each other**.

↓ You don't need any special skills to participate in time banking. For example, you can even give your time to help someone move house!



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Common goods

THIS BELONGS TO EVERYONE

Some resources belong to just one person, or a group of people, like a private car or house. But there are others that belong to everyone, to the community: these are called **common goods**. This means everyone can use them. Examples include natural resources, like plants and minerals, and also rivers, mountains, and beaches. Cities and the areas used by their inhabitants, like parks and schools, may also be common goods. But precisely because these goods are common, it is important that the people who use them **take good care of them**. This can be ensured with so-called **cooperation agreements**, which are written agreements describing the good to be protected and also how to take care of it. These rules aim to have everyone committed to playing their part as effectively as possible. In fact, it's not just **local authorities**—the bodies that manage

cities and regions—who must protect common goods and ensure that they function efficiently, but also citizens. By disposing of trash in trash cans instead of littering, for example, they can help make sure that the environment is kept clean and in a good condition for everyone to enjoy.



A cooperation agreement can be drawn up to take care of a public park.



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SHOWDOWN IN BUNNYBURROW!



I'm joking, of course. Finding Skunkington's truck here? No surprise at all!

They're loading it with rubble right now!

And along with the rubble, oils, paints, asbestos, and other harmful materials as well!

At first they're piled up separately, but then...



Look over there!
Skunkington's trucks put
everything back together,
in spite of the rules!



All this is
definitely not
in tune with
nature!

But it's not enough!
Before calling the ZPD,
we need incontrovertible
proof that they're
breaking the law!

Otherwise,
there's a risk Chief
Bogo will suspend us
again... and this time
permanently!

Hmm...
I think I have
an idea!



Yax, can I get
your doctor's
number?

Are you
feeling ill?

Never felt
better!

And so, shortly after
saying goodbye to Yax...

By collecting these
material samples and then
comparing them to the poisoned
water in the river... we'll have
those lowlifes right where
we want them!





Wrong, bunny!
We're the ones
who have you!

Hey!



Give me back my
phone, you--

Or calling for
reinforcements!

Don't even thinking
about putting up a fight,
you meddling cop!

Speaking of
which... where's
her partner?



There he goes,
in that public self-
driving car!!

Ha! It looks like
he's in a hurry to
get outta here!

Gaspl!

I can't
believe it! He
left me!

Ah, but you're
in good company,
bunny!

Hello, Clawhauser?
Yes, yes, I know we're not
back at the station yet
and that Chief Bogo
is furious!

But you
need to listen to
me! I need you to
pass on an urgent
message...

Hey, the bunny's
got guts!

Good for
her. She'll need
them...

WHACK

... when
she meets
the boss!

Hey, don't
you dare--
Mmph!

CHUG-
CHUG-
CHUG

In you go,
bunny!

Haw,
haw!

Mr. Skunkington
can't wait to
meet
you, cop!



I know what you're doing, Skunkington!

You mean saving time, effort, and money by throwing the remains of the old factory into the river rather than separating and safely disposing of the debris? Good idea, don't you think?

This way I keep all the money from my waste disposal contract!

Yeah, we're against wasting ... money!

You won't get away with it, you scumbags!

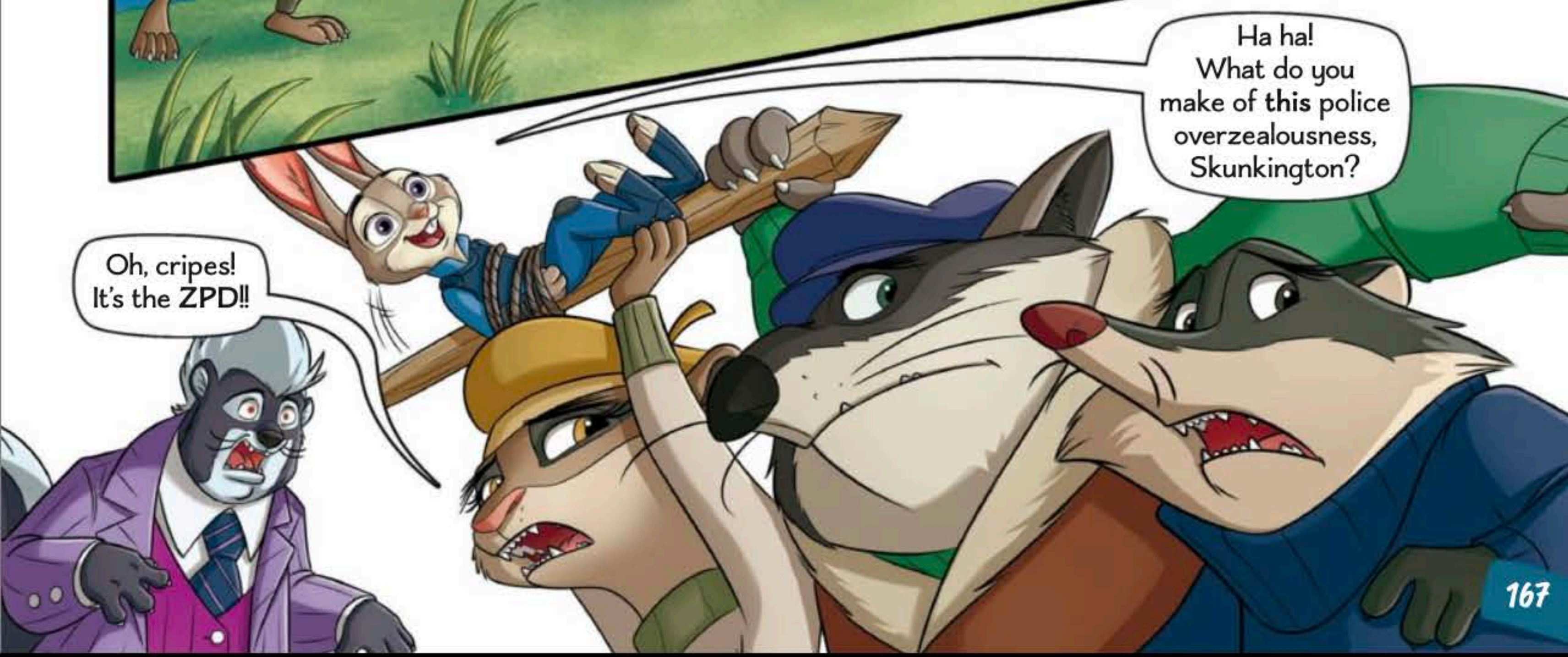
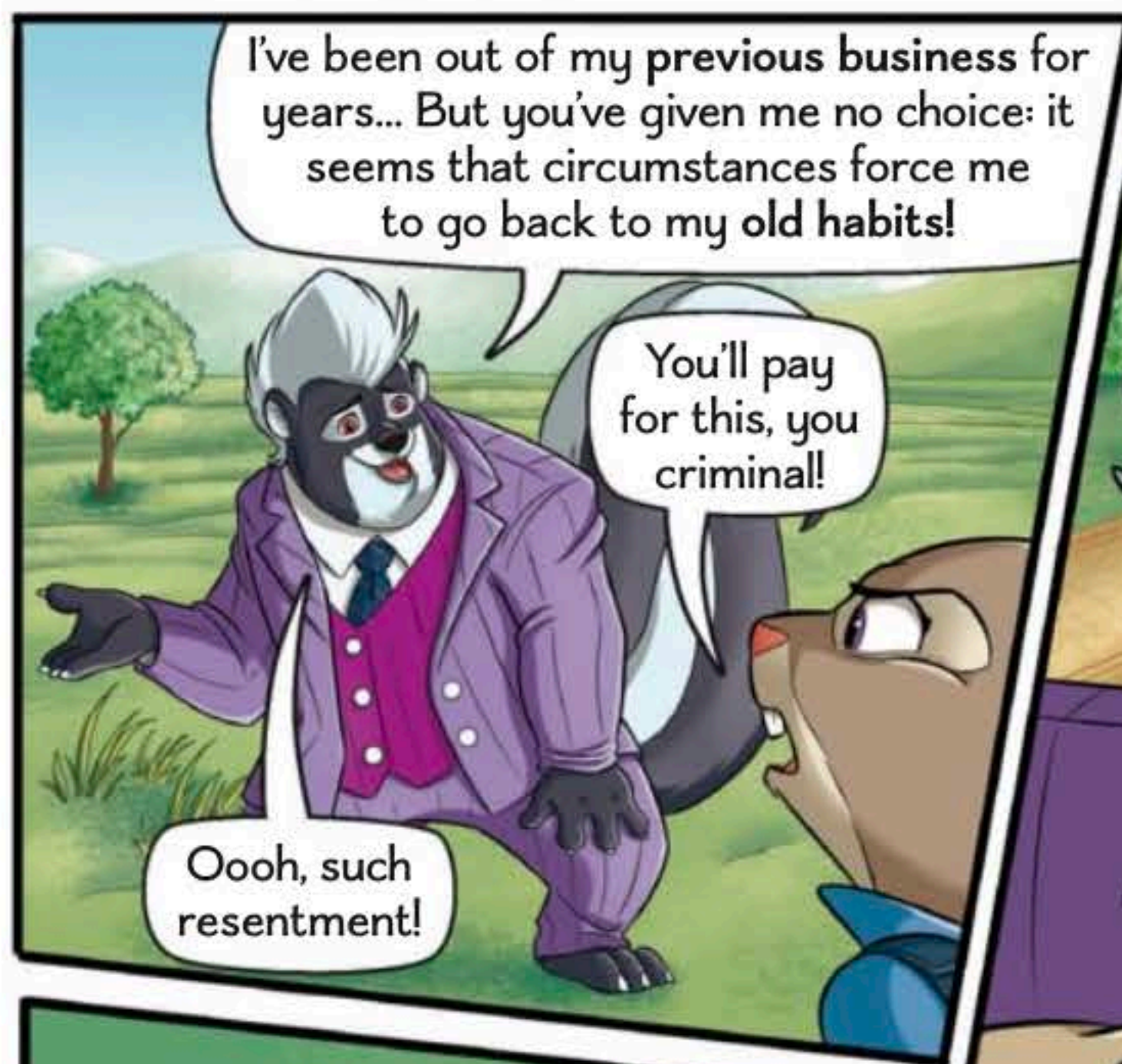
Oh, I really think we will!

Your partner is off our tail!

And if you think anybody's gonna find you in time, you're making a huuuge mistake!

We're in Bunnyburrow's countryside!

But not at the same spot as last time!! We're not stupid!





Mr. Skunkington, you are under arrest for illegal dumping of toxic substances!

And a police officer!

I escaped that, luckily. You were right on time!



But... But how?

How did they track me down? Thanks to this!

Yax's biometric sensor!



"I borrowed it from Yax before saying goodbye! It's an example of Evolville's IoT technology!"



"IoT stands for the Internet of Things! This is made up of everyday objects, which are connected to the Internet in order to exchange data between them..."



Sensor to control the climate, humidity, and irrigation of vineyards



Watch that reminds you about appointments



Smart fridge: signals which foods are running out or nearing their expiration dates



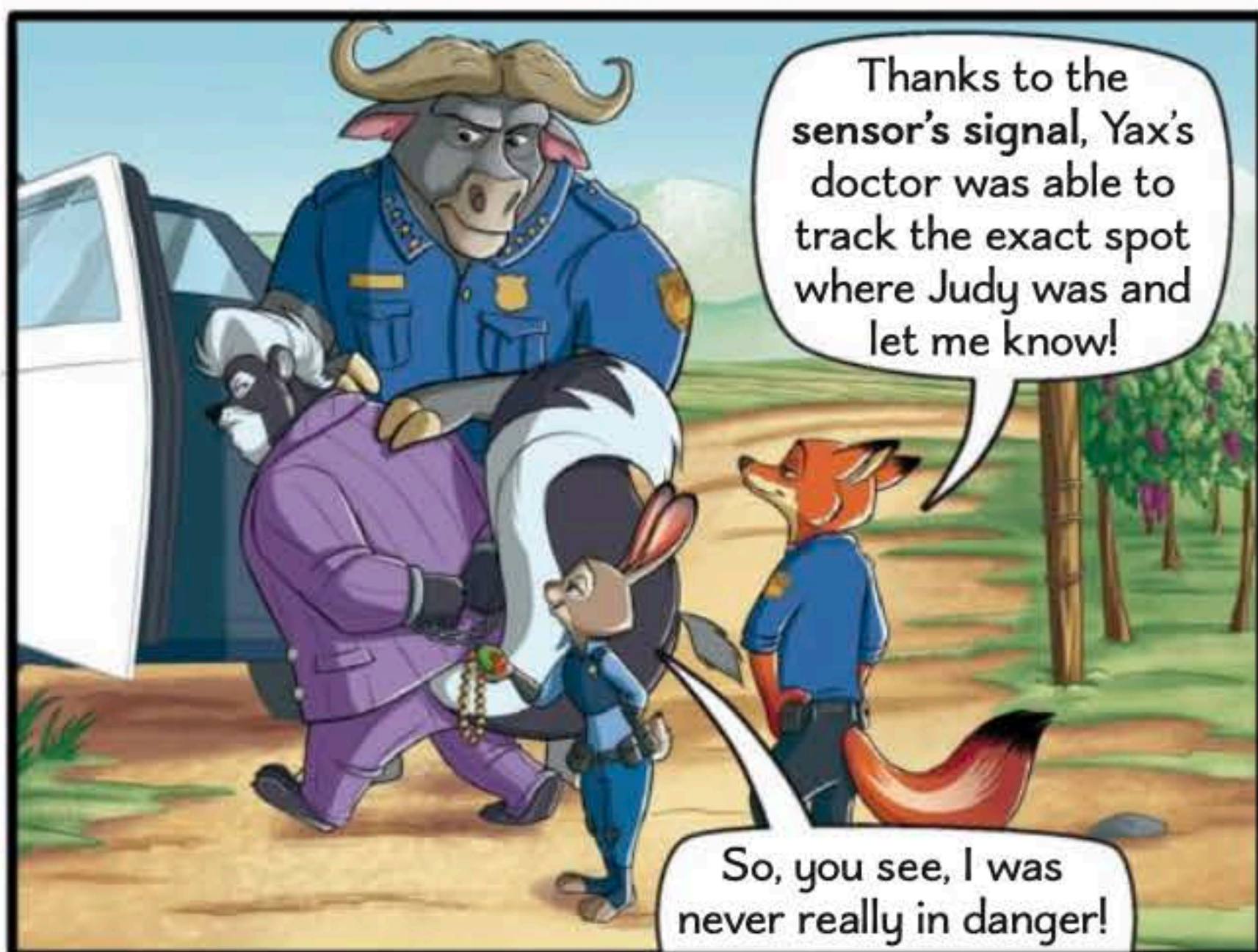
Smart thermostat to save energy



Street lamp that only turns on only when light is needed



"So they can monitor, control, and transfer information, which is then used to carry out certain actions!"





It's true that telemedicine solves lots of problems!

Well, Officers Hopps and Wilde, turns out you were right! I'll be waiting for you at the station for your report!

If it's okay with you, Chief, we have one stop to make first!

We're off to tell my folks that from now on the water will be clean and their carrots will grow healthy again!

Well said, partner!

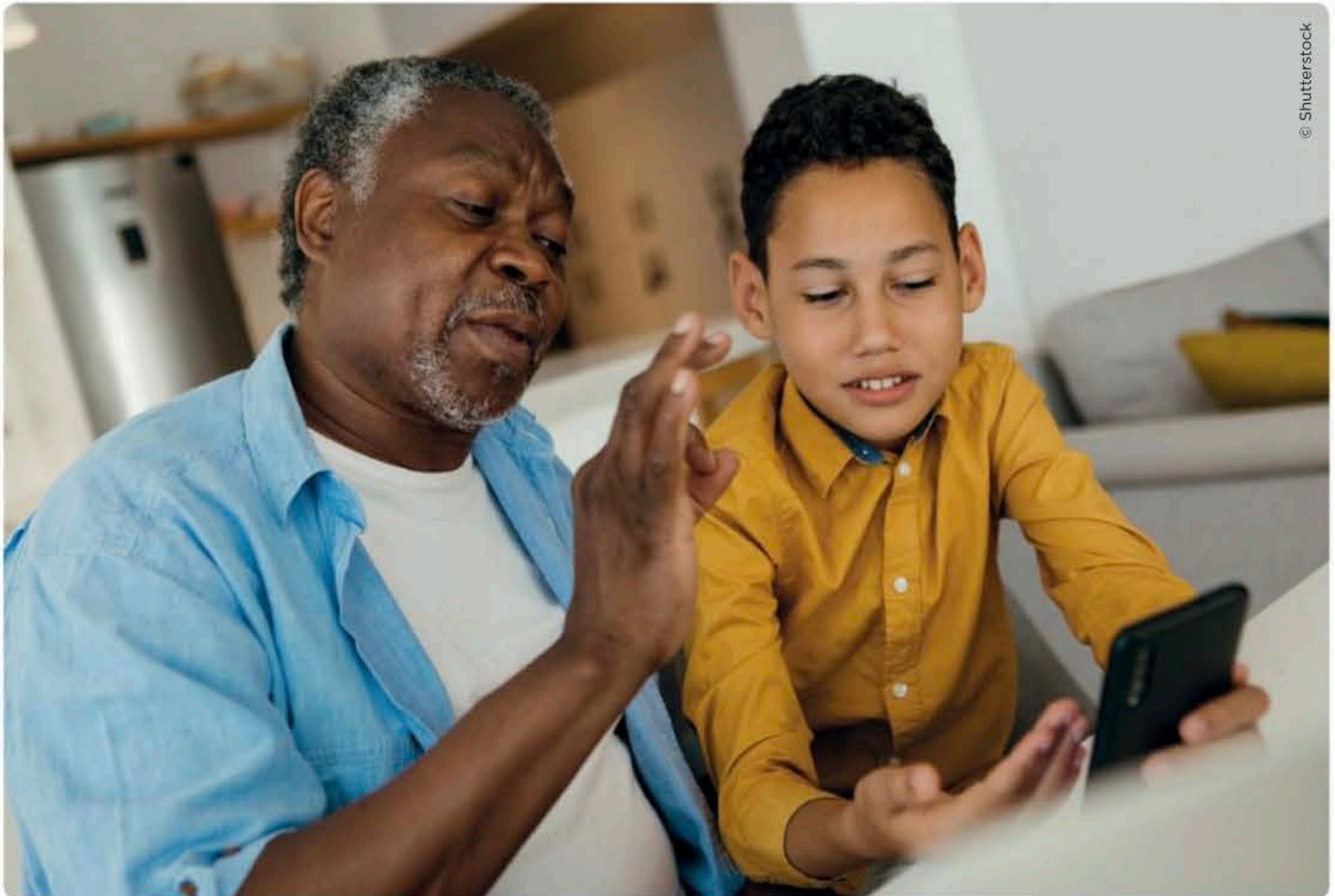
≡Munch≡
I have to admit, they're starting to grow on me!

THE END

SMART CITIES

- Improved and smarter services
- Shared digital platforms
- Biometrics and telemedicine
- Challenges for the future

Improved and smarter services



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AN EASIER LIFE

Smart cities are cities that are designed to enable us to live as well as possible, for example, by allowing citizens—today and increasingly in the future—to use specific services without leaving their homes. By means of digital technology, in fact, people can quickly access many services such as shopping, banking, medical appointments, and so on,



Those who are good with technology can help less skilled people use digital services.

from their homes, enabling them to spend less time on everyday engagements and more on the things they enjoy. **Urban planners** and city administrators can also optimize **bus routes** to better meet people's needs by studying the flow of people in relation to bus traffic, making moving from one place to another much more efficient.



THE INTERNET OF THINGS

IoT stands for the **Internet of Things**, which consists of a series of objects and devices that can connect to the Internet; for instance, cars and refrigerators, but also smart light bulbs. Indeed, these objects are equipped with software that connects them to the Internet and allows them to **exchange information with other connected objects**. The information exchanged and gathered within the connection network can be used to help people live better and to save resources. For example,



The IoT is also useful in farming. Devices placed among crops can detect soil moisture levels to show when the plants need watering.

smart thermostats measure the temperature inside a house and send the data to the owner's smartphone even when they're not home. This allows the owner to turn on and adjust the heating or air-conditioning only when necessary, remotely, by using their phone based on the temperature data received from the smart thermostat. This way, energy can be saved and less pollution created, while still keeping the house warm or cool as needed.

Shared digital platforms

WORKING AND STUDYING FROM HOME

Digital technologies are important for carrying out many activities, including working remotely. This is called **teleworking** and lets people work from different places without

having to go to their usual office or workplace. This is made possible by using various devices like computers, tablets, and smartphones connected to the Internet, which allow individuals to contact coworkers and clients and participate in meetings via **videoconferencing**.

Similarly, the lessons that usually take place at school can also be done remotely using **digital platforms**.

These are online spaces to which students and teachers can connect and where they can see and talk to each other, exchanging information just like in a classroom. However, in order to participate effectively in remote lessons, the right equipment is needed: a device, like a tablet or a computer, a **fast Internet connection**, and a quiet space to stay while taking part in the lessons. Having access to all of this gives students the great opportunity to study remotely. In this way, even those

who live far from schools or don't have easy access to transport can participate in lessons.



Distance learning has been fundamental for people at home during the COVID-19 pandemic.

Biometrics and telemedicine

TELEMEDICINE

Did you know that these days medicine can be practiced remotely? This is done by using **digital devices** that check a patient's health. They can be worn by the patient, as in the case of smartwatches or fitness trackers, and are connected to the

Internet. These instruments are able to monitor, or keep track of, certain important values such as **heart rate**—which is how fast the heart beats—and **blood pressure**. After they've gathered this information, the devices send it to the doctor, who checks it and assesses the situation, deciding whether or not the patient should be seen in person.



This is called **telemedicine**, meaning remote medicine, and it allows patients to connect directly to a doctor even from home, without the need to go to a hospital or doctor's office right away. This system also

allows doctors to constantly monitor more patients, including those who live in **difficult-to-reach** areas. When the Internet connection works well, telemedicine is a very rapid, efficient system, saving on travel and time.



Challenges for the future

THE DIGITAL DIVIDE

Today, digital services can improve the quality of people's lives, but in order to use them, users must have an internet connection, at least one device, and also know how to use it. Many people are still excluded from these services, and that's why there is a **digital gap** between those who use technology and those who don't. That gap is called the **digital divide**. Some people prefer not to use technology, while others are not always able to, such as the elderly or people who don't speak the language of the country they're living in well enough to access online services, but also people with **fewer financial resources** who can't afford a computer or a smartphone. However, solutions exist in order to prevent them from missing out

on the benefits of technology, like free courses to improve digital skills, and non-profit organizations providing lower-income families with affordable, low-cost refurbished computers. Unfortunately, though, more work is still needed to ensure everyone has access to a fast internet connection. This is one of the challenges to overcome in the cities of tomorrow.



↑ Learning to use technology at school helps reduce the digital divide among young generations.

CHECK ARENA

Now that you've read the comics, test your knowledge with some sustainable development questions! Are you ready?

Challenge yourself and your friends! Score **a point for each correct answer** and let the town-planning expert in you win!

1

Monoculture, i.e. growing a single product in the same field over and over again, exposes crops to a greater risk of diseases than growing mixed products.

☐ TRUE ☐ FALSE



2

Some food waste can be used to produce other things, like clothing.

☐ TRUE ☐ FALSE

3

What energy communities do is sharing electric batteries and power cables.

☐ TRUE ☐ FALSE

4

With telemedicine, it's not possible to continuously monitor a person's health status.

☐ TRUE ☐ FALSE

5

Once dispersed in the environment, a biodegradable product decomposes into non-polluting matter.

☐ TRUE ☐ FALSE



6

People who live in places that are increasingly compromised by rising temperatures and natural disasters, due to climate change, often try to migrate to other territories.

☐ TRUE ☐ FALSE

7

Landfills can be a good source of metals, such as copper and iron.

☐ TRUE ☐ FALSE

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10

One of the purposes of the future cities is the sharing of spaces and resources for more harmonious living.

☐ TRUE ☐ FALSE

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8

Having a city where everything is easily reached within 15 minutes means having a city with very fast public transport.

☐ TRUE ☐ FALSE

9

IoT stands for the "Intelligence of Things". This is made up of "smart" everyday objects that are interconnected in order to exchange data with each other.

☐ TRUE ☐ FALSE

YOUR SCORE

Check the answers at the bottom of the page and add up your score.

Less than 5 correct answers

Maybe you missed a few passages, but . . . you're lucky: comics are fun—especially this one!

Read the stories again and next time you'll really score for sure!

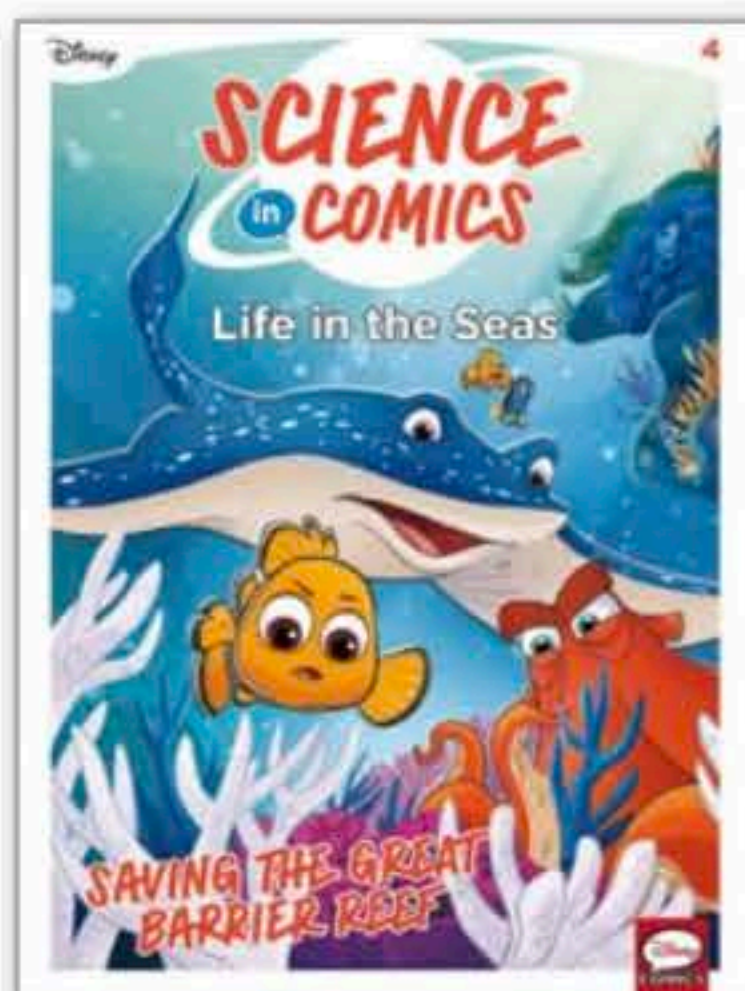
More than 5 correct answers

Congrats! You know a lot about sustainable city development: you'd be an amazing urban planner!

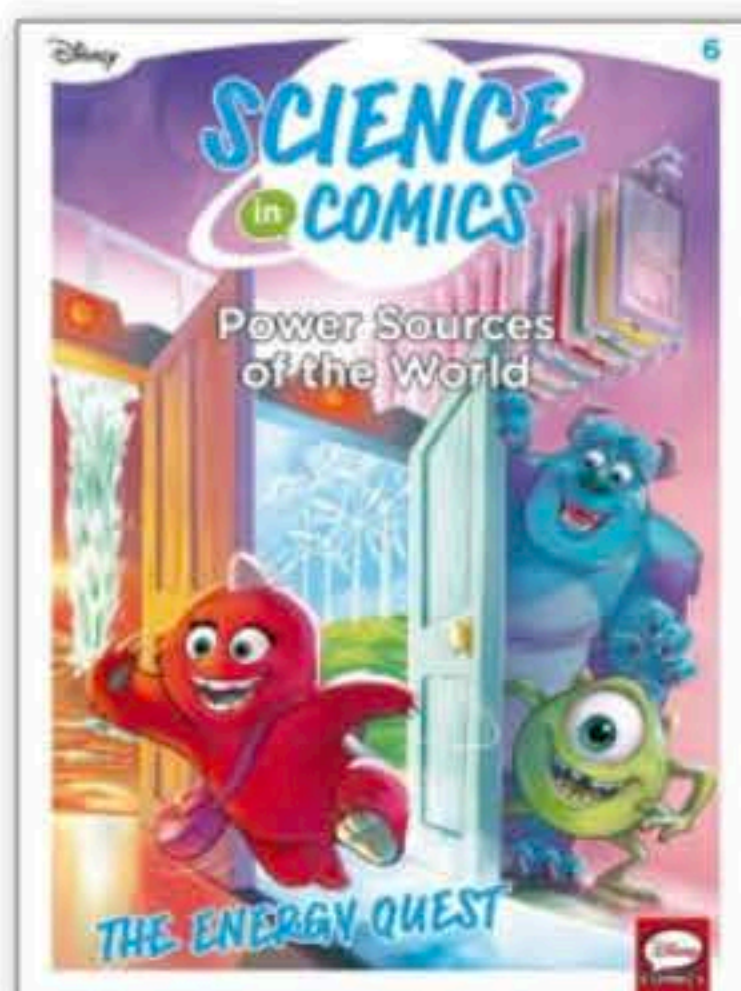
Answers and solutions: 1. False, SOLUTION: Go to page 23, 2. True, SOLUTION: Go to page 41, 3. False, SOLUTION: Go to page 139, 4. False, SOLUTION: Go to pages 155, 5. True, SOLUTION: Go to page 42, 6. True, SOLUTION: Go to page 125, 7. True, SOLUTION: Go to page 80, 8. False, SOLUTION: Go to page 126, 9. False, SOLUTION: Go to page 169, 10. True, SOLUTION: Go to page 137.

Cities of Tomorrow

Who would ever believe that, of all places, **something bad could happen in Bunnyburrow**? When she realizes that something is wrong with her father Stu's crops, Agent JUDY HOPPS, along with inseparable partner NICK WILDE, is determined to find out what's going on! The duo's investigation will unfold through **the most modern and advanced buildings and the metropolitan districts of Zootopia**. Will they be able to solve the case? Read on to find out!



**Marvels of the
marine ecosystem**



**Where our energy
comes from**

Look for additional **Science in Comics** volumes for more fun and adventure! Don't miss out on the chance to discover the secrets of the world around you!

